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Stone (M. W.), Foley (F. B.) & Bixby (D. H.). **Effect of Soil Applications of Insecticides on the Growth and Yield of Vegetable Crops.**—*Circ. U.S. Dep. Agric.* no. 926, 19 pp., 5 figs., 6 refs. Washington, D.C., 1953.

The following is virtually the authors' summary. Studies to determine the effect of annual soil applications of toxaphene and chlordane at 20 lb., aldrin at 4 lb. and ethylene dibromide at 3 U.S. gals. per acre on vegetable crops were begun at Oxnard, California, in March 1949. Each of these treatments and an untreated check were tested in six randomised blocks on 15 kinds of vegetables for three years. The growth and yield of tomatos, peppers [*Capsicum*], cabbage, cauliflower, spinach, lettuce, beet, peas, sweet potatoes and Ventura lima beans were not affected by any of the treatments. After the second or third application of toxaphene, there was a trend towards lower yields of Fordhook lima beans, celery and carrots. After three annual applications of this insecticide, the yield of potatoes was reduced substantially below that of the check plots. The yield of onions was also reduced after the third application of ethylene dibromide, but this was due primarily to *Fusarium* rot.

Chemical analyses of the soil indicated that approximately 45 per cent. of the toxaphene remained in the soil a year after the second application. No significant amounts of toxaphene were present in lima beans, potatoes or sweet potatoes grown in soils treated with this insecticide. No aldrin residues were found in the soil or in potatoes or lima beans. A panel of tasters in 1951 were unable to detect any off-flavour in green lima beans or in tomatos grown in soils treated with aldrin, chlordane or toxaphene, but potatoes were found to show significant off-flavour.

Gressitt (J. L.), Flanders (S. E.) & Bartlett (B.). **Parasites of Citricola Scale in Japan, and their Introduction into California.**—*Pan-Pacif. Ent.* **30** no. 1 pp. 5–9, 5 refs. San Francisco, Cal., 1954.

The following is substantially the authors' summary. During the first half of 1951, a search was made in Japan for natural enemies of *Coccus pseudomagnoliarum* (Kuw.), an important pest of *Citrus* in California. The population of this scale is very low throughout Japan, and on *Poncirus trifoliata*, its preferred food-plant, it appears to be under effective biological control. None but incidental predators were found, but the parasites, *Coccophagus japonicus* Comp., *C. yoshidae* Nakay., *C. hawaiiensis* Timb., *Microterys okitsuensis* Comp. and *Anicetus annulatus* Timb. were reared from the scale and sent to California. They were liberated in central and southern districts, and the first three were subsequently recovered in the places of liberation.

Stein (L. H.) & Smith (A. J.). **Uptake and Degradation of labelled Systemic Insecticides. Part II. Treatment of Tobacco and Potatoes with Systox.**—*J. S. Afr. chem. Inst.* (N.S.) 7 no. 2 pp. 114–119, 4 refs. Johannesburg, 1954.

Stein (L. H.). **Part III. Estimation of the more toxic Degradation Products of Systox.**—*T. c.* pp. 120–124, 4 refs. (With Summaries in Afrikaans.)

Owing to its activity as an inhibitor of cholinesterase, Systox (35 per cent. O,O-diethyl O-2-(ethylmercapto)ethyl thiophosphate [demeton-O], 15 per cent. O,O-diethyl S-2-(ethylmercapto)ethyl thiophosphate [demeton-S] and 50 per cent. emulsifier) has been used for the systemic control of insects only on plants not intended for human consumption. In the first of these two parts of a series [*cf. R.A.E.*, A **41** 191], an account is given of tests in

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South Africa to determine how much of the insecticide or its more toxic degradation products [*cf.* **44** 230] is present in potatoes and tobacco at various intervals after treatment. The method of estimation is described in the second part.

Tobacco seedlings planted out on 18th October 1953 were sprayed on 30th November with 0·05 per cent. of a mixture in which the Systox ingredients were present in their normal proportions but the demeton-S was labelled with radioactive phosphorus (^{32}P). The plants were sampled in groups of five when the spray was dry and 1–28 days after treatment, and it was found that the total content of Systox in the leaves decreased from over 2 mg. to less than 0·2 mg. over the whole period, degradation being disregarded, and there was no further loss due to drying the samples at 96°C. [204·8°F.]. The final amount present represented less than 3 parts per million of the dry weight of the leaves. Rainfall between sampling dates did not affect the results significantly. When tobacco that had been transplanted on 23rd November 1953 was treated on 8th January 1954 by pouring the mixture on to the soil at the rate of 2 gals. per sq. yard, contact with the plants being avoided, and leaves were sampled 3–53 days later, the amount of Systox in p.p.m. of their dry weight increased from less than 50 to about 400 in the lower leaves and to nearly 700 in the top leaves. Approximately 40 per cent. of the total was found in the lower leaves 17–53 days after treatment, and flue-curing caused no loss.

Potatoes planted on 8th December 1953 received the same soil treatment as the tobacco on 25th January 1954, and samples were taken from the plants above ground 7, 21 and 35 days after treatment and from the tubers 56 and 92 days after it, and the contents of Systox in p.p.m. of the wet weight were about 7, 42, 46, 123 and 84, respectively. It is pointed out that the results obtained exaggerate the level of toxicity very considerably, since no account was taken of the degradation of the insecticide and the fact that demeton-O disappears more rapidly than demeton-S [*cf.* **44** 232].

Isaakidès (C. A.). **La mouche des olives.**—*Pragm. Akad. Athen.* **20** pt. 5 repr. 28 pp., 1 fig. Athens, 1954. (With a Summary in Greek.)

The author reviews the bionomics of *Dacus oleae* (Gmel.) on olives in Greece and the various methods of control that have been used against this Trypetid there and elsewhere. He considers that the present high rate of infestation in Greece is largely due to the elimination of natural enemies caused by excessive clean cultivation in olive groves, involving the destruction of all undergrowth, and the use of modern contact insecticides, and proposes measures for the re-establishment of conditions favourable for the development of biological control, including the abandonment of insecticidal treatments other than arsenical bait-sprays. The insects found attacking *D. oleae* in Greece [*cf. R.A.E.*, A **34** 326] are *Prolasioptera berlesiana* (Paoli), which is predacious on the eggs but is associated with the fungus, *Macrophoma dalmatica* [*cf.* **43** 173–4, etc.], and *Eupelmus urozonus* Dalm., *Pnigalio* (*Eulophus*) *longulus* (Zett.), *Eurytoma rosae* Nees and *Dinarmus dacicida* Masi, which parasitise the larvae. Notes are given on their bionomics.

de Azevedo (A. R.). **Ensaio comparativo da acção do parathion, Diazinon e do malathion contra as larvas do** *Dacus oleae*. [A Comparative Test on the Action of Parathion, Diazinon and Malathion against the Larvae of *D. oleae*.]—*Agron. lusit.* **18** no. 1 pp. 75–82, 2 refs. Sacavém, 1956. (With a Summary in English.)

In view of the risk of toxic parathion residues remaining in the oil from olives treated against *Dacus oleae* (Gmel.), tests were carried out in Portugal

in which the effectiveness of this material was compared with that of Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] and malathion. All were applied at 0·03 and 0·06 per cent. in sprays prepared from emulsion concentrates, on 23rd September, when many larvae had reached the third instar in the fruits and the olives were beginning to change colour, and again on 13th October, when they were completely black. Larval mortality was estimated about 15 days after each treatment, and the combined average percentages, obtained by angular transformation of the original percentages, were, for the two concentrations, respectively, 60·2 and 58·4 for parathion, 38·8 and 45·7 for Diazinon and 10·2 and 15·8 for malathion, corresponding mortality among the controls being 0·75 per cent. The frequency with which punctures did not result in infestation was generally higher on trees sprayed with parathion or Diazinon than on those sprayed with malathion or left untreated. None of the materials gave commercial control.

MONASTERO (S.). **Sui rapporti tra fattori climatici e infestazione dacica (*Dacus oleae* Gmel.—mosca delle olive).** [On the Relation between climatic Factors and Infestation by the Olive Fly, *D. oleae*.]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 9–33, 4 pls. (1 fldg.), 21 refs. Palermo, 1955. (With Summaries in French and English.)

After reviewing the literature on the effects of environmental factors on populations of *Dacus oleae* (Gmel.), the author discusses the influence of rainfall and temperature on the intensity of infestation of olives in the light of observations made in Sicily since 1926, with particular reference to 1951 and 1952, when the attack was moderate and very severe, respectively. He concludes that no direct correlation exists between these factors, alone or in conjunction, and the intensity of the infestation, though they exercise a considerable modifying influence over it.

MONASTERO (S.). **Prove dimostrative di lotta contro la mosca delle olive eseguite in Sicilia nel 1953 (*Dacus oleae* Gmel.).** [Demonstration Tests on the Control of the Olive Fly in Sicily in 1953 (*D. oleae*).]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 45–62, 4 pls. (3 fldg.), 3 refs. Palermo, 1955. (With Summaries in French and English.) **Prove di lotta contro la mosca delle olive (*Dacus oleae* Gmel.) a mezzo di prodotti organici sintetici: D.D.T. e parathion (Didifos 50) ed estere tiofosforico (Malatox) eseguite in Sicilia nel 1953.** [Tests on the Control of *D. oleae* with synthetic organic Products: DDT and Parathion (Didifos 50) and Thiophosphoric Esters (Malatox) carried out in Sicily in 1953.]—*T. c.* pp. 63–73, 1 ref.

In the first paper, a detailed account is given of tests already noticed on the value of arsenical bait-sprays for the control of *Dacus oleae* (Gmel.) on olive in Sicily in 1953 [*cf. R.A.E.*, A **44** 195–196].

In the second, two subsidiary tests carried out at the same time with sprays of organic insecticides are described. In the first of these, a product containing 40 per cent. DDT and 10 per cent. parathion was applied at 1 lb. per 5 gals. water five times beginning on 6th–8th July and ending on 2nd–3rd October. Adults were already present when treatments were begun, but large numbers were not taken until September or early October. The olives on the treated trees remained free from infestation until 28th September, and few infested ones were found beneath the trees before that date. By 30th September and 3rd and 20th October, up to 25 per cent. of the olives on the

treated trees had been punctured, but none contained living larvae. On 30th October, 15th November and 4th January, the percentages of olives infested were 1·4, 32 and 21, respectively. At picking, on 4th–20th January, 80 per cent. of the olives were still on the trees, and only 20–35 per cent. were infested, as compared with 80–100 per cent. infestation by October on the untreated trees. Analyses of the oil from treated olives showed 51·5, 34 and 26·9 parts DDT per million in samples picked on 5th November, 5th December and 20th January, respectively, and further analyses of oil from fruits picked on the same dates showed 97, 58 and 36 p.p.m. DDT and 3, 1 and 1 p.p.m. parathion, respectively. In view of these high residues, the treatment cannot be recommended.

In the second test, sprays of malathion, applied on 1st July, 13th August and 1st September to olives growing among other fruit trees, proved quite ineffective.

GENDUSO (P.). **Prove di lotta contro la *Ceratitis capitata* Wied. in Provincia di Palermo a mezzo di derivati clorurati di sintesi ed esteri fosforici.** [Tests on the Control of *C. capitata* by Means of synthetic Chlorinated Derivatives and Phosphoric Esters.]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 75–85, 7 refs. Palermo, 1955.

The author briefly reviews from the literature recent experiments on the control of *Ceratitis capitata* (Wied.) with synthetic organic insecticides, and gives an account of tests carried out on peach in 1953 near Palermo, in Sicily, where late varieties have been severely attacked, particularly where peaches are grown in association with other fruits, though the degree of infestation is variable.

In the first test, sprays of 0·25 per cent. DDT were applied on 6th, 11th, 16th and 21st July to peaches of a variety maturing in early August that had not been attacked by the first of these dates. Mandarin oranges in the same orchard were sprayed with parathion. The treatments failed to protect the peaches, and all were infested by late July.

The second test was carried out on another variety maturing in August, in an orchard in which most of the peaches were protected by paper bags. These trees were sprayed with 0·04 per cent. wettable dieldrin on 23rd June, 2nd, 12th, 18th and 25th July and 1st August, and some, on which the fruits were not protected, were given the dieldrin spray on the first three dates and one of 0·25 per cent. wettable DDT on 18th, 22nd, 26th and 31st July and 4th August. On the latter, infestation at picking reached 75·4 per cent., as compared with 100 per cent. on untreated trees by 24th July.

In a third planting, containing two varieties and situated near a mixed orchard, an emulsified solution of 0·3 per cent. DDT was applied on 2nd, 12th, 19th and 26th July and 4th August to a variety maturing in late July and early August. At picking on 3rd, 8th and 10th August, the percentages of fruits infested on the treated and (in brackets) untreated trees were 20·6 (39), 19 (38) and 14 (41), respectively.

MONASTERO (S.). **Morfologia e biologia del *Mytilococcus gloverii* Packard 1869 (cocciniglia lunga-stretta degli agrumi).** [Morphology and Bionomics of *Lepidosaphes gloverii* (Citrus Long Scale).]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 87–135, 7 pls., 2 maps (1 fldg.), 31 refs. Palermo, 1955. (With Summaries in French, English and German.)

Lepidosaphes (*Mytilococcus*) *gloverii* (Pack.) has not reappeared in peninsular Italy since an incipient infestation on *Citrus* at Pisa was destroyed in

1920, but it was observed to the north-west of Palermo, in Sicily, in 1947 and spread rapidly in the immediate neighbourhood, about 19 per cent. of the *Citrus* trees in the province being infested in 1953–54. Its distribution there is shown on maps, all stages of the Coccid are described, its wider distribution, food-plants and natural enemies are reviewed from the literature and the damage caused is discussed. In the field, five generations a year were observed, adults first appearing about 25th March, 25th May, 25th July, 20th August and 15th October, respectively. In laboratory observations none of the individuals that hatched in January–June reached the second instar, but rearing was successful from late June to November. The females laid 18–40 eggs each in 6–40 days, and the duration of the egg stage ranged from ten days in June–July to 50 in January–March. The females reached the young adult stage in a further 37 days in August–October and an average of 44 days in July–November, and the period from hatching to adult emergence in the males ranged from 27 to 44 days.

In tests on control, good results were given by sprays of 0·03 per cent. of an emulsion concentrate containing 46·6 per cent. parathion and 0·2 per cent. of one containing 20 per cent. parathion, which were superior to a mineral-oil spray. The parathion sprays were applied on 5th April and the mortality percentages reached 100 and 80, respectively, by 20–25th April. Infestation then increased, and a second application was made on 25th May. This gave 100 and 95 per cent. mortality, respectively, and both sprays retained their effectiveness throughout June and July. No ovicidal effect was observed. A few adults of a parasite, thought to be *Aspidiotiphagus citrinus* (Craw), were observed emerging from immature examples of *L. gloverii* in August–October.

Monastero (S.). **I diversi metodi di lotta antidacica al vaglio della sperimentazione fatta in Sicilia nel 1954.** [The various Control Measures against *Dacus oleae* evaluated in the Light of Experiments carried out in Sicily in 1954.]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 137–165, 4 pls. (3 fldg.), 1 fldg. map, 8 fldg. tables, 3 refs. Palermo, 1955. (With Summaries in French, English and German.)

Experiments on the control of *Dacus oleae* (Gmel.) on olive were carried out near Palermo in 1954 by means of bait-sprays, sprays of parathion alone or with DDT, and trap-glasses of the type developed in Spain [*cf. R.A.E.*, A **35** 151], containing 5 per cent. diammonium phosphate. Adults were present throughout the year, and oviposition began on irrigated trees in June and non-irrigated ones in July, the percentage infestation on unprotected trees of the two types reaching almost 100 and 40–50 by late September, respectively, after which it continued to increase on the latter. The bait-spray was the same as that used in Sicily in 1953 [*cf.* **44** 196], containing 2·5 per cent. sodium arsenite, and it was diluted 1:9 and applied to irrigated olives growing among *Citrus* in the coastal plain and to non-irrigated olives on neighbouring slopes, on 16th–20th July, 10th–14th August, 1st–4th and 20th–24th September, 2nd–6th October (followed by heavy rain) and 19th–23rd October. Good protection was given until late September, but by 20th October the infestation percentages on the non-irrigated and irrigated trees had reached 7–79 and 74–86·5, respectively, as compared with about 100 for no treatment. Many of the infested olives on treated trees were still commercially sound, however, whereas those on untreated ones were of inferior quality.

The trap-glasses were hung from 4th February among some 300 irrigated trees consisting mainly of two varieties, and from about mid-June, when the numbers of adults taken began to increase, the number was raised from 37

to 810, distributed at the rate of 1–6 or even eight per tree, depending on the size of the latter. Little control was afforded. All the fruits of the table variety were infested by 30th August, and infestation on the other reached 25 per cent. on 30th August and 93 per cent. by 25th September.

When an emulsion concentrate containing 40 per cent. DDT and 10 per cent. parathion was applied at 1 per cent. on 24th July, 13th September and 19th October to non-irrigated trees in the coastal plain, the percentages of fruits commercially sound (with punctures only or containing dead individuals only) on the treated and (in brackets) untreated trees were 86·5 (91) on 6th September and 50 (37) at picking on 25th October. The residue of DDT in the oil from olives picked on 5th November was 2·9 parts per million; there was no residue of parathion. When the same product was applied at 2 per cent. on 1st August and 13th September to a few trees on the slopes, 20–25 per cent. of the fruits were infested by 15th November, as compared with 70–80 per cent. for no treatment. The residues in the oil from olives picked on 22nd October were 3·5–5·3 p.p.m. parathion and 12–17·2 p.p.m. DDT. An emulsion concentrate containing 20 per cent. parathion was applied at 1 per cent. on 14th September to trees in both non-irrigated and irrigated areas, 56 and 35 per cent. of the olives, respectively, being commercially sound at the time. At picking, on 25th October and 5th November, respectively, the corresponding percentages were 40 and 24, as compared with 31 and 15, respectively, for no treatment. There was a residue of 1·4 p.p.m. parathion in the oil from a combined sample taken from the two plots on 5th November.

Monastero (S.). **Il bosco di Ficuzza minacciato dal bombice dispari** (*Lymantria dispar* **L.**). [The Forest of Ficuzza threatened by *L. dispar*.]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 167–174, 3 pls. Palermo, 1955.

In 1953–54, oaks in a mixed forest near Palermo were severely attacked by larvae of *Lymantria dispar* (L.). Hatching began in early April, and the largest numbers of adults were present in June and July, the females ovipositing in July and early August. In the laboratory, the larvae hatched in the last decade of March and pupated in mid-May, giving rise to adults in late May and early June. The larval and pupal stages averaged about 50 and 15 days, respectively. Adults paired 3–4 days after emergence, and the females laid 300–700 eggs each. For control, egg masses were removed from the trees during the autumn and winter and destroyed, and sprays were applied in spring against the larvae. Good results were given by a product containing 46·6 per cent. parathion applied at 0·05 per cent., an emulsion concentrate containing 30 per cent. DDT applied at 1 per cent. and a product containing 19·5 per cent. endrin applied at 0·5 per cent. Lower concentrations gave inferior results.

Monastero (S.). **Insetti del mandorlo.** [Insects on Almond.]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 177–188, 5 pls. Palermo, 1955.

Notes are given on the bionomics and control of various insects that attack almond in Sicily. These comprise *Malacosoma neustria* (L.), which defoliates the trees, *Hyponomeuta padellus* (L.), the larvae of which web the shoots together in spring and feed on the buds and young leaves, *Capnodis tenebrionis* (L.), which completes its development in two years, the larvae mining between the bark and the wood of the trunks, *Anthonomus amygdali* Hust. (*ornatus* Reiche), which develops in the flower buds, and the Tingid,

Monosteira unicostata (Muls. & Rey), large numbers of which are present on the lower surfaces of the leaves. Damage by Aphids is not normally severe.

GENDUSO (P.). **Un insetto dannoso ai cavolbroccoli (sparacelli): il *Rhytidoderes plicatus* Oliv.** [An Insect damaging Broccoli: *R. plicatus*.]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 189–193, 2 pls. Palermo, 1955.

The weevil, *Rhytidoderes plicatus* (Ol.), was observed causing considerable damage to broccoli near Palermo in 1953. Large numbers of larvae were present among the roots, and those collected in December gave rise to adults in August. The females oviposited between the second half of August and the first half of November, laying 200–500 eggs each on the soil near the plants. The eggs hatched in about 15 days, and the larvae entered the soil and fed on the roots. They became full-fed between late January and early March, constructed earthen cells at a depth of about 12–16 ins. and pupated in early May, passing the intervening period in diapause. The pupal stage lasted about two weeks, but the adults did not leave the soil until the end of August. They fed on the leaves of the young plants, but caused little damage. No satisfactory method of controlling the larvae was found; chlorinated insecticides proved effective against the adults, but would have to be applied every 15–20 days over a considerable period to afford complete protection.

CIRRITO (M.). **Notizie su un insetto dannoso ai carciofi (*Hydroecia xantenes* Germ.).** [Notes on an Insect Pest of Artichokes (*H. xanthenes*).]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 195–200, 1 pl., 3 refs. Palermo, 1955.

Hydroecia xanthenes (Germ.), all stages of which are briefly described, causes considerable damage to artichokes (*Cynara*) in Sicily, and observations on its bionomics [*cf. R.A.E.*, A **44** 312] were made near Palermo in 1954. These showed that some 5 per cent. of the first-year plants and 10–12 per cent. of the second-year ones were infested. Larvae were first observed in the field towards the end of January. They tunnelled through the midribs of the leaves and entered the main stems in February and March, tunnelling downwards to the collar or entering the stems of the inflorescences; some left the leaves and made their way externally to the inflorescences, entering them and again boring downwards. Larvae were commonly found in the collar region at the end of April, and few penetrated beyond this. Pupation occurred in the base of the stem towards the end of August, and the pupal stage lasted 25–30 days. Adult emergence was observed from 21st September to 20th October, and the females began to oviposit two days after emergence.

It is recommended for control that the plants should not be cultivated for more than a year, the roots being removed from the fields after harvest in late March and all plant parts destroyed.

FARAONE (G.). **La *Plagiolepys pigmea* Latr. nell'agro palermitano.** [*P. pygmea* near Palermo.]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 201–203, 1 ref. Palermo, 1955.

The ant, *Plagiolepis pygmea* (Latr.), has spread considerably near Palermo in recent years, causing anxiety to farmers. The author observed it

principally on *Citrus* and, together with Aphids, on leguminous crops. In control tests in 1955 with chlordane, to which the ant had been reported to be resistant, two products each containing 50 per cent. chlordane were applied in sprays on 21st April at 0·25 and 0·5 per cent., respectively, and a rate of about 1·5 pints per 4 sq. yards, on two heavily infested plots containing *Citrus* and beans. Large numbers of ants were dead on 27th April and the plots remained free from infestation for about 20 days. The treatment at 0·5 per cent. was also effective against Aphids on the beans.

Vivona (A.). **La tignoletta dell'uva in Sicilia ed i mezzi di lotta più efficaci** (*Polychrosis botrana* **Schiff.**). [The Vine Moth in Sicily and the most effective Control Measures (*Lobesia botrana*).]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 205–215, 1 pl., 1 graph. Palermo, 1955.

Lobesia (*Polychrosis*) *botrana* (Schiff.) has become widespread throughout Sicily of recent years and causes considerable damage to grapes in the north-west of the island. The larva, pupa and adult are briefly described. Observations showed that there are three complete generations a year, with sometimes a partial fourth. Most damage was caused by larvae of the second and third generations, particularly those of the third, which attacked the grapes about two weeks before picking. DDT is recommended for control, and should be applied when oviposition is at its height in each generation. As these dates precede by a few days the peaks of adult flight as determined by trap jars, applications should be made when substantial increases in catches are noted over several days. Good results were given in a nursery by three applications of dusts containing 5 and 10 per cent. DDT at about 18 and 9 lb. per acre, respectively. The first treatment was applied on 10th–20th June, the second a month later, and the third after a further 20 days. It is suggested that the fungicides normally applied to the vines should be added to the DDT dust on the first two dates. A fourth application of DDT has not been found necessary.

Scavone (G.). **Gravi danni prodotti al cotone dalla** *Platyedra* **o** *Gelechia gossypiella* **Saund. Esperimenti di lotta.** [Severe Damage to Cotton by *P. gossypiella*. Experiments on Control.]—*Boll. Ist. Ent. agr. Palermo* **1** (1954–55) pp. 217–220. Palermo, 1955.

Platyedra gossypiella (Saund.) causes considerable damage to cotton in Sicily [*cf. R.A.E.*, A **35** 419] and is responsible for losses of 20–30 per cent. of the yield. There are 4–5 generations a year on the island. The injury caused is briefly described, and control measures are reviewed, including disinfestation of the seed and applications of organic insecticides in the field. Good results were given near Catania in 1952 by four applications of a parathion spray.

Graniti (A.). **Ricerche sulle anomalie fogliari dell'olivo in Sardegna. II. Alterazione riferibili all'azione di** *Pollinia pollinii* **Costa.** [Investigations on the Deformation of Olive Leaves in Sardinia. II. Lesions attributed to the Action of *P. pollini*.]—*Ann. Sper. agr.* (N.S.) **10** no. 3 pp. 983–991, 5 pls., 16 refs. Rome, 1956. (With a Summary in English.)

In this second paper of a series [*cf. R.A.E.*, A **42** 360], the author gives detailed descriptions of the deformations of the leaves of olive caused by the

feeding of the Coccid, *Pollinia pollini* (Costa), in Sardinia. Infestation and the consequent growth of sooty mould is often severe, and leads to die-back of the branches.

Cuscianna (N.). **Evoluzione dei sistemi e dei mezzi per la lotta contro la formica argentina** (*Iridomyrmex humilis* **Mayr). Parte I.** [The Development of Systems and Methods for the Control of the Argentine Ant (*I. humilis*). Part I.]—*Ann. Sper. agr.* (N.S.) **10** no. 3 suppl. pp. lxxi–cxiii. Rome, 1956. (With a Summary in English.)

In 1945, infestation by *Iridomyrmex humilis* (Mayr), which has been present in north-western Italy since 1922–23, was found to have increased considerably in extent and intensity in the neighbourhood of Sanremo, as a result of the suspension of control operations during the war. The measures previously adopted comprised the use of traps [*cf. R.A.E.*, A **18** 46] in autumn and arsenical baits in summer [*cf.* **8** 285], but though these had proved effective, difficulties were encountered in enforcing their use throughout the affected areas. These methods again gave good results in 1945–47. However, in 1948–50, tests were made with chlorinated insecticides, and detailed accounts are given of the results afforded by numerous commercial products, applied in dusts and sprays to the surface of the soil in infested, cultivated plots, with notes on their phytotoxicity. Large-scale operations were carried out in 1950 with DDT. It is concluded that good control can be obtained by repeated treatments with DDT at high concentrations and rates of application in emulsified solutions or in colloidal sprays prepared from a commercial product that leaves a fine crystalline film of DDT and has good adhesive qualities, or by two applications of concentrated chlordane emulsion sprays.

Antunes de Almeida (A.). **Os insectos do tabaco armazenado.** [The Insects in stored Tobacco.]—*Estud., Ensaios Docum.* **16,** 9¾ × 7 ins., 111 pp., 15 pls., 58 refs. Lisbon, Minist. Ultramar, Junta Invest. Ultramar, 1956. (With Summaries in French and English.)

The most important pests of stored tobacco in Portugal are *Ephestia elutella* (Hb.) and *Lasioderma serricorne* (F.), and in this work the author describes all stages of both insects, reviews the literature on them and gives accounts of studies on their bionomics. *E. elutella* had two generations a year, the adults emerging in early or mid-April and August, respectively, in both laboratory and warehouse. The females oviposited 1–2 days after pairing and laid 48–112 eggs each, usually singly, but occasionally in groups of 4–5, in the folds and wrinkles of the tobacco leaves, near the midrib. The eggs of the first generation hatched in 9–28 days, with an average of 12–13 days, at 18–20°C. [64·4–68°F.], and those of the second in 4–6 days at about 25°C. [77°F.]. First-generation larvae became full-fed in 85–90 days at 23°C. [73·4°F.] in the laboratory and in 55 days at 25°C. in a greenhouse. Those of the second generation were present during winter, development being continuous except when temperatures fell too low. The pupal stage was completed in 10–15 days at 25°C., but required 30–35 days in early spring. The thresholds of development for eggs and larvae were found by the method of Blunck and Bodenheimer [*cf. R.A.E.*, A **13** 389] to be 14·3°C. [57·74°F.] and 18·8°C. [65·84°F.], respectively. The optimum relative humidity for the larvae was 13 per cent. and the minimum for development was 10 per cent.

L. serricorne also had two generations a year, the adults emerging in June and late August, respectively. The females oviposited 2–8 days after pairing, laying 10–26 eggs each on the tobacco leaves, though they would not oviposit on leaves that were completely dry. The eggs hatched in 11 days at 24·4°C. [75·92°F.] and in six days at 26·1°C. [78·98°F.], the larval stage lasted 46–71 days at 24·7–25·3°C. [76·46–77·54°F.] and the pupal stage was completed in 6–11 days at an average temperature of 23–25°C. The calculated thresholds of development were 19°C. [66·2°F.] for the eggs and pupae, and 15·2°C. [59·36°F.] for the larvae.

A parasite of *Lasioderma* identified as *Anisopteromalus* (*Aplastomorpha*) *calandrae* (How.) was taken in a tobacco factory on the island of Madeira together with the predator, *Thaneroclerus buqueti* (Lef.). In Lisbon, the mite, *Pediculoides ventricosus* (Newp.), was found preying on larvae of *L. serricorne* in tobacco imported from Italy.

Cardoso da Costa (J. M.). **Contribuição para o estudo da defesa fitossanitária da copra do ultramar português.** [A Contribution to the Study of the phytosanitary Protection of Copra from Portuguese Overseas Territories.]—*Estud., Ensaios Docum.* **17**, 9¾ × 7 ins., 100 pp., 15 pls., 53 refs. Lisbon, Minist. Ultramar, Junta Invest. Ultramar, 1955. (With Summaries in French and English.)

Copra imported into Portugal from Mozambique and the island of São Tomé, in the Gulf of Guinea, is commonly damaged by fungi, bacteria and insects, infestation presumably originating in the territories of production. The extent of the damage and its results are discussed in the first part of this work, in which it is shown that 57·6 per cent. of samples taken from storage warehouses in Portugal in 1952 were infested, 25·3 per cent. of them by insects. The resulting loss was about 6 per cent. of the total value.

Of the insects found, *Necrobia rufipes* (Deg.) was by far the most important. All stages of this Clerid are described in detail, its distribution, synonymy, bionomics, and range of foods are reviewed, the substances thought attractive to it in copra are discussed [*cf. R.A.E.*, A **23** 440], and an account is given of observations on its development in the laboratory. These showed that the females oviposited more readily on copra that was attacked by bacteria and fungi than on that that was not, 86·6 per cent. of the eggs then hatching, as compared with 58·3 per cent. on sound copra. The larvae hatched in four days at 25·5°C. [77·9°F.] and nine days at 19·6°C. [67·28°F.], and fed on the copra, showing some preference for the surface away from the tegument. Mortality was high if the copra was sound [*cf.* **26** 31]. They also fed on eggs and young larvae of their own species and on larvae of other insects. The larval stage lasted 43 days at about 32°C. [89·6°F.] and 95 days at 23·8°C. [74·84°F.]. The pupal stage lasted for a maximum of 29 days at 25·5°C. and a minimum of 6 days at about 32°C. Adult males survived for an average of 37 days if the copra was sound and for 106 days when it was mouldy, and the corresponding figures for the females were 42 and 112. There was a preoviposition period of at least two days, and the females laid 10–153 eggs each in 6–75 days. The minimum and maximum durations of the life-cycle were 56 and 119 days, at about 30·8°C. [87·44°F.] and 23·3°C. [73·94°F.], respectively. The thresholds of development for the egg, larval and pupal stages, calculated by the method of Blunck and Bodenheimer [*cf.* **13** 389], were 14·5°C. [58·1°F.], 20·6°C. [69·08°F.] and 18·2°C. [64·76°F.], respectively. The influence of humidity and light on development is briefly discussed; high relative humidities shorten the life-cycle and low ones prolong it and increase larval mortality.

European and Mediterranean Plant Protection Organisation. **Colorado Beetle in Europe in 1953, 1954, 1955.** [*In English and French.*]—[5+] 14 [+3+] xi pp.; [5+] 17 [+1+] xv pp.; [3+] 21 + xix pp., multigraph. Paris, 1954, 1955, 1956.

These further reports are similar in scope and arrangement to that for 1952 [*R.A.E.*, A **41** 300]. Infestation of potato by *Leptinotarsa decemlineata* (Say) was generally less severe in 1953 than in that year, but there was some advance to the south. The whole of the Province of Algarve in southern Portugal became infested, together with further areas in the Spanish Provinces of Malaga, Seville and Cadiz. The beetle also spread southwards along the east and west coasts of Italy, and in Yugoslavia the infestation became general in Slovenia and spread to Croatia, the total infested area in the country being almost doubled and the intensity of attack greatly increased. Local extensions occurred in Austria [*cf.* **42** 337] and Luxembourg. There was also some increase in Schleswig-Holstein, and colonies were found in southern Denmark but were eradicated. Conditions were unfavourable for the development of the beetle in 1954 and 1955. There was a limited spread to the north in Schleswig-Holstein in 1954, but a reduction in infested areas in north-western Europe in 1955, localities in France, Belgium, Holland and western Germany that had been infested in previous years being free from attack. No infestation occurred on the Danish frontier. In Spain, however, infestation advanced towards the extreme south, there was some local spread in eastern Austria, and considerable spread in Yugoslavia, particularly in Croatia, the newly-infested area there being three times as large in 1955 as in 1954. Infestation was found for the first time in Serbia, though the area affected was small.

Jermy (T.) & Sáringer (G.). **A burgonyabogár** (*Leptinotarsa decemlineata* **Say).** [The Potato Beetle, *L. decemlineata*.]—*Növényvéd. Kut. Int. Kiadv.* no. 4, 188 pp., 101 figs., 11 pp. refs. Budapest, 1955. (With Summaries in Russian and German.)

Leptinotarsa decemlineata (Say) was first observed on potato in Hungary in 1947 [*cf. R.A.E.*, A **37** 117] but did not appear in numbers until 1951, when beetles entered from Yugoslavia. The number of foci of infestation increased rapidly from that time, and over 8,000 were recorded in 1953, when invasion also occurred from Austria. There were concurrent increases in Poland, eastern Germany and Czechoslovakia. Observations on the bionomics of the beetle showed that the depth at which the adults overwintered in the soil was usually about 2–6 ins. and did not exceed about 9 ins. Mortality was 34–92·5 per cent. in the winter of 1953–54 and was highest in marshy ground. Resumption of activity occurred over a period of two months and was not associated with any particular soil or air temperature. The beetles sometimes wandered for considerable distances, and feeding did not begin until about 10th May. Eggs were laid between late May and mid-August, their numbers varying with the number of hours of sunshine, and first-generation adults appeared in July. Some of these oviposited after feeding, but the majority entered the soil for hibernation. The second generation was small, and there was no third. Observations on the effect of temperature on larval and pupal development, and the indigenous plants that serve as food for the larvae and adults, are recorded. DDT is effective against the feeding larvae and young adults, and is widely used for control. Mixtures of DDT and γ BHC are still more effective and are employed while the young adults are emerging, and soil treatments with BHC or carbon bisulphide are applied after harvest against beetles that have entered hibernation. Investigations

on resistant strains and hybrids of potato have been begun. The natural enemies of *L. decemlineata* observed in the field comprised *Nabis rugosus* (L.), *Zicrona coerulea* (L.), *Chrysopa vulgaris* Schneider and *Meigenia mutabilis* (Fall.), but the last was unable to complete its development in the larvae.

COMPERE (H.). **A systematic Study of the Genus *Aphytis* Howard (Hymenoptera, Aphelinidae) with Descriptions of new Species.**—*Univ. Calif. Publ. Ent.* **10** no. 4 pp. 271–319, 19 figs., 29 refs. Berkeley, Cal., 1955.

In this revision of the genus *Aphytis*, the author lists 31 species and two varieties, of which 13 species are described as new, and gives notes on the diagnostic characters, identity, hosts and distribution of those known to him, which comprise the great majority. The use of some species in biological control is also discussed. Keys are given to a group of closely related genera that include *Aphytis* and to the species, including those of the groups of *A. proclia* (Wlk.), *A. mytilaspidis* (LeB.) and *A. chrysomphali* (Merc.).

The new species include *A. dealbatus* from *Lepidosaphes ulmi* (L.) on willow (*Salix*), *A. melanostictus* from *Aspidiotus juglans-regiae* (Comst.) on walnut, and *Aphytis citrinus* from *Aonidiella citrina* (Coq.) on orange, all in California; *Aphytis merceti* from *Lindingaspis* (*Chrysomphalus*) *rossi* (Mask.), *Melanaspis* (*C.*) *corticosus* (Brain), *Hemiberlesia rapax* (Comst.) (*Aspidiotus camelliae*, auct.) and *Ceroplastes destructor* Newst. at Cape Town, South Africa; *Aphytis cylindratus* from *Pseudaonidia duplex* (Ckll.) on persimmon in Japan; *A. lepidosaphes* from *Lepidosaphes beckii* (Newm.) on orange in China; *A. lingnanensis* also from China; and *A. immaculatus* from *Lepidosaphes* in Formosa. *A. lepidosaphes* was previously recorded as *Aphelinus* sp. [*R.A.E.*, A **18** 320] and as *Aphytis* X [**44** 132, 240], and *A. lingnanensis* as *Aphytis* A [**39** 235; **40** 385; **42** 306; **44** 239]. *A. diaspidis* (How.), *A. maculicornis* (Masi) and *A. hispanicus* (Merc.) are recognised as distinct species within the group of *A. proclia*, though *A. maculicornis* is variable [*cf.* **43** 355], and *Aphelinus capitis* Rust [**3** 357] and *Aphytis longiclavae* (Merc.) [**39** 91] are considered synonyms of *A. chilensis* How.

CALCAGNOLO (G.) & SAUER (H. F. G.). **Novos resultados no combate ao ácaro do algodoeiro** (*Eotetranychus telarius* (L.)). [New Results in the Control of *Tetranychus telarius*.]—*Biológico* **21** no. 10 pp. 173–184, 3 graphs, 6 refs. São Paulo, 1955.

Experiments on the control of *Tetranychus* (*Eotetranychus*) *telarius* (L.) on cotton in Brazil [*cf. R.A.E.*, A **44** 220] were continued in 1954–55, the products applied and the concentrations of toxicant at which they were used comprising Aramite (2-chloroethyl 2-(p-tert.butylphenoxy)-1-methylethyl sulphite) at 0·15 per cent., Chlorocide (p-chlorobenzyl p-chlorophenyl sulphide) at 0·05 per cent., Dowspray 17 (dinex (dicyclohexylamine)) at 0·053 per cent., F.W.293 (1,1-bis(p-chlorophenyl)-2,2,2-trichloroethanol) at 0·075 per cent., Ovotran (p-chlorophenyl p-chlorobenzenesulphonate) at 0·6 per cent., Sulphenone (p-chlorophenyl phenyl sulphone and related compounds) at 0·7 per cent., and sulphur at 1 per cent., all in wettable-powder sprays, and Systox (diethyl 2-(ethylmercapto)ethyl thiophosphate [demeton]) at 0·03 per cent., Folidol M50 (methyl-parathion) at 0·02 per cent., Dimite (1,1-bis(p-chlorophenyl)ethanol) at 0·032 per cent. and G-24353 (ethyl 4,4′-dichlorobenzilate) at 0·05 per cent. in emulsion sprays. All were applied at about 36 gals. per acre in two fields, in which infestation became apparent 75–80 days after planting and continued for some 60 days. Applications were

made in the first field at the beginning of the infestation and again 30 days later, when all the plots except those treated with Systox had become reinfested. The second application was followed by heavy rain. In the second field, the sprays were applied at the peak of the infestation, about a month after its first appearance. Counts were made before and 48 hours after treatment, and control percentages were calculated according to a formula already noticed [**26** 82]. In the first field, Systox gave complete control and Ovotran gave 99 and 82·2 per cent. after the two applications, respectively. Of the other materials, Sulphenone, F.W.293, G-24353, sulphur and Aramite gave significant control (88·2, 82·2, 81, 78·6 and 74·8 per cent., respectively) after the first application but not after the second. and the other materials were ineffective on both occasions. In the second field, the percentages were 99·1 for Systox, 90·4–98·4 for Sulphenone, Aramite, F.W.293 and sulphur, 83·7–87·3 for Dimite, G-24353 and Ovotran, and 65·8–73·5 for the other materials. The results given by all the products except Dowspray 17 were found to be significantly better than no treatment. Since Systox was the only one of the effective products to retain its effectiveness for more than 10–15 days, three applications of the others will normally be necessary for control; the intervals recommended are 10–15 and 20–25 days.

Puzzi (D.), Andrade (A. C.) & Camargo (J. C.). **Experiência de contrôle à mosca das frutas em 1955.** [Experiments on the Control of *Ceratitis capitata* in 1955.]—*Biológico* **21** no. 10 pp. 185–188, 2 graphs, 5 refs. São Paulo, 1955.

In view of severe infestation by *Ceratitis capitata* (Wied.) on *Citrus* in São Paulo, a comparative experiment on control was carried out on orange in 1955 with emulsion sprays containing 0·135 per cent. γ BHC, 0·5 per cent. toxaphene, 0·046 per cent. parathion and 0·0925 per cent. dieldrin, 3 per cent. sugar being added to all the sprays, and to the water applied to the control trees, as an attractant. The trees were sprayed with bordeaux mixture towards the end of petal-fall, and the experimental sprays were applied on 4th and 28th May, 24th June and 17th July. At picking, on 30th August, the percentages of fruits attacked averaged 9·1 for dieldrin, 12·1 for toxaphene, 19·9 for γ BHC and 20 for parathion, as compared with 28·2 on the control trees. The reductions given by dieldrin and toxaphene were shown to be significant.

Massey (C. L.) & Wygant (N. D.). **Biology and Control of the Engelmann Spruce Beetle in Colorado.**—*Circ. U.S. Dep. Agric.* no. 944, [1+] 35 pp., 12 figs., 4 refs. Washington, D.C., 1954.

The following is based on the authors' summary of this account of investigations carried out in western Colorado since 1944 on the bionomics and control of *Dendroctonus engelmanni* Hopk., a Scolytid that caused severe losses of Engelmann spruce (*Picea engelmanni*) and to a less extent of lodgepole pine (*Pinus contorta*) there in 1939–51. The beetle takes either one or two years to complete its life-cycle. In the one-year cycle, the tree is attacked from mid-June or early July, and pupae and immature adults are present by early October. The pupae give rise to adults in the course of the winter, but the adults do not become sexually mature until mid-June or early July. In the two-year cycle, the trees are attacked in mid-July, and the larvae overwinter from mid-October. Adults are present in the following

June–July, and they usually leave the trees in August and September, but fall or crawl to the bases of the trees from which they have emerged and form small feeding galleries in which they pass the winter. Those that do not leave the trees in autumn hibernate in the bole of the tree in which they have developed, emerging from hibernation in the latter part of June and in July.

Woodpeckers are the most effective predators of *D. engelmanni*, and almost the entire brood is destroyed by these birds in certain areas. Insect parasites and predators, a list of which is given, are responsible for about 50 per cent. of the mortality in the later stages. Low temperatures at times destroy the brood over extensive areas; during mid-winter, all larvae are killed by a subcortical temperature of −30°F. and all adults by −20°F. The experiments on control have been noticed from an earlier account [*R.A.E.*, A **42** 285].

Struble (G. R.) & Hall (R. C.). **The California Five-spined Engraver, its Biology and Control.**—*Circ. U.S. Dep. Agric.* no. 964, [1+] 21 pp., 7 figs., 11 refs. Washington, D.C., 1955.

The following is based on the authors' summary of this account of studies in 1945–51 in California on the bionomics and control of *Ips confusus* (Lec.). This Scolytid is indigenous in southern Oregon and California, and its sporadic attacks on pines, especially *Pinus ponderosa*, growing at 2,000–4,500 ft. above sea level are most frequently associated with the presence of slash resulting from logging or clearing operations. In stands of mature trees, top-killing is characteristic, whereas complete killing is common in stands of young trees up to 24 ins. in diameter. Though the beetle has long been known, it was until recently considered to be a secondary pest associated with *Dendroctonus brevicomis* Lec. Unprecedented logging in 1943–51, especially in second-growth ponderosa pine, resulted in large accumulations of fresh slash, a favoured breeding ground for *I. confusus*, and outbreaks of this Scolytid then killed standing pines on a scale previously unknown.

The studies showed that fresh slash in the form of unlopped tree tops left after logging operations in February–July is heavily attacked from April, the adults emerging from midsummer onwards and ovipositing in standing trees. Severe outbreaks are also associated with slash resulting from windfalls, tree damage by snow, and land-clearing activities. They rarely last for more than a year, but are often followed by outbreaks by *D. brevicomis*. *I. confusus* has 3–4 generations a year in most areas, though two or five may develop at the extremes of latitude, depending on seasonal temperatures. Outbreaks are favoured by temperature and moisture conditions optimum for development and a moisture content of the soil too low to maintain the trees in vigorous health. Unfavourable weather and natural enemies check infestations, but never completely control them. Early-season breeding can be reduced or prevented by lopping tree tops, scattering limbs and exposing bark surfaces containing infestations to full sunlight, late cutting operations, and the use of sprays of DDT in oil to prevent attack on logs or slash. Direct control may be necessary if heavy populations, together with *D. brevicomis*, threaten to kill large numbers of trees, and the methods recommended are burning infested material when possible, spraying with o-dichlorobenzene in stove oil or diesel fuel (1:6) or 1·5 lb. ethylene dibromide in 5 U.S. gals. oil, applied as a solid stream to the upper surfaces of the logs as they are rolled, until all the bark is saturated, or salvage logging, which consists in the prompt despatch of infested logs to the sawmill where they are immediately sawn into lumber and the slabs containing infested wood burnt, the beetles thus being mechanically destroyed before they complete their development.

Benjamin (D. M.). **The Biology and Ecology of the Red-headed Pine Sawfly.**—*Tech. Bull. U.S. Dep. Agric.* no. 1118, [1+] 57 pp., 24 figs., 34 refs. Washington, D.C., 1955.

The following is based on the author's summary. Studies on the bionomics, ecology and control of *Neodiprion lecontei* (Fitch) were carried out in southern Illinois in 1947–49 and in central Michigan in 1948–49. All stages of this sawfly are described, and a map is given showing its distribution in the east of the United States and Canada, together with records of outbreaks of it that have occurred there since 1935 and lists of the trees attacked [*cf. R.A.E.*, A **9** 267]. In the Lake States, jack pine (*Pinus banksiana*) is preferred, though red pine (*P. resinosa*), Scots pine (*P. sylvestris*), Austrian pine (*P. nigra*) and Swiss mountain pine (*P. mugo*) are also attacked. In the south of the United States, shortleaf pine (*P. echinata*) is preferred, and south of the range of this species, loblolly pine (*P. taeda*), longleaf pine (*P. palustris*) and slash pine (*P. elliottii*) are infested. In the north-east of the United States and in Canada, *P. resinosa* is preferred [*cf.* **41** 56]. In all regions, the available species of hard pine is attacked in the absence of the preferred food-plant.

N. lecontei overwinters as a prepupa in a cocoon spun in the soil. Pupation occurs in spring, and adult emergence, pairing and oviposition follow rapidly. The females lay an average of 102–141 eggs per batch in the needles. The average number of eggs per needle ranges from 5·6 on Virginia pine (*P. virginiana*) to 12·2 on *P. resinosa*. The larvae feed as a gregarious colony on the needles, attacking those on the leader and branch tips from the third instar onwards. Defoliation progresses from the top of the tree towards the base. The larvae leave defoliated trees and migrate to fresh ones. In tests, they moved up to 19 ft. across bare sand to establish themselves, but mortality was heavy at soil-surface temperatures above 105°F. Migration across sodded areas was more successful. There are 3–5 generations a year in the southern United States, 2–3 per year in mid-central areas, and one generation a year in the north and in Canada. A diapause of the prepupae lasting up to five years has been reported. A list is given of 58 species of natural enemies that attack the sawfly. The egg parasite, *Closterocerus cinctipennis* Ashm., was a prime factor in the reduction of populations in Illinois in 1947–48; *Spathimeigenia spinigera* Tns. and *Phorocera hamata* Aldr. & Webber were the most important of the larval parasites.

The observations showed a linear relation between the number of trees infested and the severity of defoliation. On *Pinus echinata* from 4 to 6·9 ft. in height, defoliation increased from 29 per cent. at the 10 per cent. infestation level to 59 per cent. at the 75 per cent. infestation level. On plantations ranging from 2 to 3·9 ft., defoliation was 32 per cent. at the 10 per cent. infestation level and 73 per cent. at the 75 per cent. infestation level. In Michigan, there was a relation between the intensity of infestation of *P. banksiana* and the number of sawfly colonies per tree. As the percentage infestation increased, greater numbers of trees suffered multiple attack. In both regions, defoliation was more severe and the number of trees attacked greater in shaded than in open areas, oviposition being concentrated on pines in the shaded parts of the plantations and on the shaded parts of open-growing pines. Heavy attacks were also common on pines shaded by hardwoods, and a survey suggested a linear relation between the amount of hardwood cover and the number of trees attacked by the sawfly. In both areas, reservoir populations persisted on shaded pines and in areas of poor tree survival between outbreaks. The meteorological factors affecting the sawfly, particularly light [*cf.* **44** 111], are discussed, and the ability of various species of pine to withstand defoliation is reviewed.

DDT is recommended for control of the larvae. Solutions of 1 lb. DDT in 1 U.S. gal. oil per acre proved satisfactory when applied from aircraft, and a 3 per cent. DDT solution is recommended for use with hand equipment. The possibility of reducing sawfly populations through silvicultural practices is discussed.

Boswell (V. R.). **Effects of Insecticides on Flavor and Quality of Food Products.**—*J. econ. Ent.* **48** no. 5 pp. 495–499, 21 refs. Menasha, Wis., 1955.

The author discusses the direct and indirect effects of insecticides on the quality of food crops and the difficulty of assessing them, and reviews published information, much of it from the United States, on the immediate effects on fruits, vegetables and groundnuts [*cf. R.A.E.*, A **38** 277, 278; **39** 261, 437] and on the cumulative effects of residues from treatments of earlier crops; these have not proved measurable in tree fruits but have been significant in vegetables and groundnuts after the application of BHC [*cf.* **44** 285] and noticeable, though variable, after treatment with some of the newer organic insecticides.

Kinghorn (J. M.). **Chemical Control of the Mountain Pine Beetle and Douglas-fir Beetle.**—*J. econ. Ent.* **48** no. 5 pp. 501–504, 1 graph, 4 refs. Menasha, Wis., 1955.

Experiments were carried out in British Columbia in 1951–53 on the control of *Dendroctonus monticolae* Hopk. in lodgepole pine [*Pinus contorta*] and *D. pseudotsugae* Hopk. in Douglas fir [*Pseudotsuga taxifolia*] by the application of bark-penetrating fumigants and residual sprays to logs and standing infested trees and the introduction of concentrated systemic poisons into the sap stream of freshly attacked trees and of healthy trees before felling. The following is based largely on the author's summary of the results.

Both Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate (demeton)] and schradan proved toxic to *D. monticolae* in laboratory tests, but failed to reduce brood survival when applied in various ways to the wood after removal of strips of bark round the base of infested pines, and schradan was also ineffective when applied in this way to firs to be used after felling as trap logs.

In tests of two fumigants and seven residual insecticides as bark sprays on infested logs, ethylene dibromide, aldrin, heptachlor and dieldrin at 3·2 lb. in 5 U.S. gals. emulsion spray containing 20 per cent. fuel oil, and lindane [almost pure γ BHC] at 0·64 lb., gave complete mortality of *D. monticolae*, ethylene dibromide being the most rapid in action, and ethylene dibromide, aldrin and heptachlor at the same rate were effective against *D. pseudotsugae* in thin-barked Douglas fir. In tests on standing trees sprayed to a height of about 30 ft., ethylene dibromide, aldrin and γ BHC at the same rates (but without fuel oil in the case of aldrin) gave good control of *D. monticolae*, with no difference between them. When used at 0·8 lb. per 5 U.S. gals. with 20 per cent. fuel oil, DDT on cut logs and DDT and chlordane on standing trees gave inadequate mortality of *D. monticolae* but were superior to ethylene dibromide or o-dichlorobenzene. At 1·3 lb. per 5 U.S. gals. with 33 per cent. fuel oil, ethylene dibromide gave complete control on standing trees, and chlordane was more effective than DDT or o-dichlorobenzene. At 1·6 lb. per 5 U.S. gals. with 20 per cent. fuel oil or at 3·2 lb. per 5 U.S. gals. with 3·5 per cent. fuel oil, ethylene dibromide gave practically complete kill of *D. monticolae* in pine

logs and it is concluded that this compound would provide an effective treatment with a margin for inadequate bark coverage if used at 2 lb. per 5 U.S. gals. with 20 per cent. fuel oil.

MICHELBACHER (A. E.). **Further Observations on the Control of the Walnut Aphid.**—*J. econ. Ent.* **48** no. 5 pp. 504–509, 6 refs. Menasha, Wis., 1955.

In further tests in 1953 of aphicides to be added to the sprays applied against the codling moth [*Cydia pomonella* (L.)], for the control of *Chromaphis juglandicola* (Kalt.) on walnut in northern California [*cf. R.A.E.*, A **41** 204; **42** 161], 0·25–1·25 lb. actual Systox [diethyl 2-(ethylmercapto) ethyl thiophosphate (demeton)] and 2·5 lb. technical schradan per acre, applied by air-carrier sprayer in early May, gave excellent control and proved somewhat better than 1 lb. 25 per cent. wettable parathion, 3 lb. wettable malathion or 7 lb. 14 per cent. nicotine dry concentrate per acre applied in the same way and than 1·5 lb. 25 per cent. parathion or 9 lb. 6 per cent. γ BHC applied with a conventional sprayer. Schradan was superior to Systox, few Aphids being found even in late autumn on trees sprayed with it in May. A further application of the non-systemic aphicides with the air sprayer in early July resulted in excellent control. In 1954, when high temperatures caused heavy Aphid mortality, single applications of all the non-systemic materials in early May gave adequate control in the interior of the State, and both Systox and schradan gave excellent results in all tests, including one in an orchard at San Jose in which the trees were infested by a strain of the Aphid known to be resistant to parathion [*cf.* **43** 58].

It was observed that satisfactory control with schradan depends on thorough coverage and, apparently, on application before the walnut foliage becomes too mature. Systox, on the other hand, has caused some foliage injury and should not be applied before the trees come into full leaf.

ANDRES (L. A.), BURTON (V. E.), SMITH (R. F.) & SWIFT (J. E.). **DDT Tolerance by *Lygus* Bugs on Seed Alfalfa.**—*J. econ. Ent.* **48** no. 5 pp. 509–513, 5 graphs, 5 refs. Menasha, Wis., 1955.

Until 1952, 95 per cent. or more reduction of *Lygus* bugs, mainly *L. hesperus* Knight, on lucerne grown for seed was usually given over most of California by treatment with 30 lb. 5 per cent. DDT with 50 per cent. sulphur per acre, but much less satisfactory results have since been obtained. Investigations on this lack of effectiveness were carried out in the San Joaquin Valley in 1953–54; as all the seed fields there are treated at least once a year, populations in lucerne hay fields were used as controls.

In 1953, the susceptibility of adults collected from untreated hay fields and treated seed fields was tested in three ways. When they were exposed to the deposits from appropriate dosages of a standard mixture of DDT and oil for one hour, the median lethal doses were 2·5–5 times as great at 24 hours for the bugs from the seed fields as for those from the hay fields. When they were dusted with 5 per cent. DDT they were over six times as great, and when they were treated topically with DDT in oil, they were ten times as great. In 1954, exposure to the deposits from DDT in oil showed that the median lethal dose for the bugs from seed fields was 1–2 times as great as that for those from hay fields at the beginning of the season and 3–5 times as great at the end of it.

These results indicate that *Lygus* has developed some resistance to DDT in seed fields, but that the degree of resistance is low and does not appear

to increase much from season to season. The problem is complicated by effects of temperature, increases in the use of toxaphene, and variations in the nutritional value of the food-plants. In 1946–48, DDT at 1·5 lb. per acre gave better and more lasting control than 3 lb. toxaphene per acre, but in 1953–54, 10 per cent. toxaphene was as effective as 5 per cent. DDT in some seed fields and much more so in others. The relative effectiveness of the poisons was apparently the same for nymphs as for adults. Toxaphene is slower in action than DDT and more harmful to the predators in the seed fields, and there is some evidence of the development of a tolerance to it similar to that to DDT. Nevertheless, this material should probably be preferred to DDT in the resistant areas, especially in the second half of summer, and also in desert areas, since, unlike DDT, it has a positive temperature coefficient.

Chamberlain (W. F.) & Cochran (J. H.). **Control of the Tomato Fruitworm in South Carolina.**—*J. econ. Ent.* **48** no. 5 pp. 518–521. Menasha, Wis., 1955.

Heliothis zea (Boddie) (*armigera*, auct.) is the most injurious insect pest of tomato in South Carolina, where it normally destroys 20–30 per cent. of the crop unless controlled. In 1949, the application of 20 lb. 5 per cent. DDT or DDD dust per acre, which reduced the infestation to 10 per cent., was the recommended treatment, and experiments were begun to determine whether control could be improved.

In 1949–50, 3–5 applications of 2 lb. 50 per cent. wettable DDT, DDD or Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis-(p-chlorophenyl)-2-nitrobutane] or 5·5 lb. 18 per cent. wettable dieldrin in 100 U.S. gals. spray per acre gave good but not commercially adequate control (about 6–16 per cent. fruits infested), whereas wettable methoxy-DDT (methoxychlor), aldrin and parathion gave rather poor control. When DDT, DDD, dieldrin and Dilan were applied to four plantings set in the field at intervals of a fortnight beginning on 1st May, seasonal differences in infestation influenced the control obtained, the effectiveness of the treatments decreasing slightly as the season advanced, regardless of whether the insect population was increasing or decreasing in untreated plots.

In 1951–53, DDT, DDD and Dilan at 3 lb. 50 per cent. wettable powder or 3 U.S. quarts 25 per cent. emulsion concentrate in 100 U.S. gals. spray per acre gave adequate control (0–2·4 per cent. fruits infested), with no significant differences between formulations, and DDT and DDD as 5 per cent. dusts at 50 lb. per acre were as effective as the sprays, but Dilan dust at the same rate was less so. The addition of adhesives to DDT emulsion or wettable-powder sprays tended to improve control, but is not recommended for commercial use in view of the excellent results obtained without them. Toxaphene was tested in several spray formulations but gave rather variable results.

None of the wettable powders or emulsion concentrates injured the plants under field conditions; slight injury occasionally resulted from the combination of insecticide and an oil adhesive, but the yield was not materially affected.

Allen (N.) & Hodge (C. R.). **Mating Habits of the Tobacco Hornworm.**—*J. econ. Ent.* **48** no. 5 pp. 526–528, 3 figs., 2 refs. Menasha, Wis., 1955.

Since ultraviolet-light traps are much more attractive to males than to females of *Protoparce sexta* (Joh.) [*cf. R.A.E.*, A **43** 320], so that their use

might cause a large number of females to remain unfertilised, investigations were carried out in South Carolina in 1954 to determine whether a male would pair with more than one female. The sexes were separated in the pupal stage and caged together only during mating studies. These indicated that pairing occurred mainly after midnight. Only virgin females were observed to mate, but individual males paired with 2–3 females on consecutive nights; it was doubtful whether a male would mate with more than one female in one night. Males were attracted from some distance to females in cages in the open, but it was noted that a female did not appear to be attractive to males near it until it lowered its abdomen.

Ahmed (M. K.). **Comparative Effect of Systox and Schradan on some Predators of Aphids in Egypt.**—*J. econ. Ent.* **48** no. 5 pp. 530–532. 6 refs. Menasha, Wis., 1955.

The following is largely based on the author's summary. The effects of Systox [diethyl 2-(ethylmercapto)ethyl thiophosphate (demeton)] and schradan on predacious insects [*cf. R.A.E.*, A **43** 208] were studied in Egypt by feeding them on examples of *Aphis gossypii* Glov. that had been killed by one of these compounds.

The Aphids were poisoned by dipping infested leaves in the diluted insecticides or by allowing them to feed on leaves with their petioles immersed in the liquids. Larvae of *Sphaerophoria flavicauda* Zett. and *Leucopis punctipennis* Mg. were readily poisoned by Aphids of either group killed by either insecticide. Larvae of *Coccinella undecimpunctata* L., *Scymnus syriacus* Mars. and *Chrysopa vulgaris* Schneider and adults of the two Coccinellids were not affected by schradan, and *Chrysopa* larvae were practically unharmed by Systox when fed on Aphids of either group. All Coccinellid larvae and adults were killed by Aphids that had had external contact with Systox, but only 0–2 per cent. of the adults and 20–27·8 per cent. of the larvae were affected by those that had merely ingested it.

Agarwala (S. B. D.). **Control of Sugarcane Termites (1946–1953).**—*J. econ. Ent.* **48** no. 5 pp. 533–537, 1 ref. Menasha, Wis., 1955.

The termite, *Microtermes obesi* Hlmgr., is a serious pest of sugar-cane at Pusa, Bihar, feeding on the canes throughout the year, and cannot be controlled by irrigation. Chemical measures [*cf. R.A.E.*, A **42** 207] were tested in 1946–54 and evaluated from their effects on germination, termite attack on the growing crop, and yield. Various dosages of BHC were applied in dusts to the cut ends of the seed pieces, in suspensions or emulsions in which the seed pieces were soaked or dipped and in suspensions or dusts scattered over seed pieces lying exposed in furrows immediately before they were covered with soil. In four seasons out of seven, some of the BHC treatments improved germination by protecting the seed pieces from attack, but treatment by the first method was insufficient because the seed piece is attacked equally at the cut end and nodal annulus and the second was wasteful and gave poor protection during growth. Scattering the insecticide in the furrow was the most effective, but attack was reduced for only about four months when 0·98 lb. γ BHC (180 lb. 5 per cent. BHC dust) was applied per acre; later, the termites increased greatly, and there was no significant gain in yield. In 1947–49, soaking the seed pieces for 15 minutes in 5 per cent. lead arsenate, 0·25 per cent. mercuric chloride or 0·5 per cent. DDT

protected them during germination, though this was reduced by lead arsenate, but gave no protection of the growing crop and had little effect on yield; DDT appeared to be better than the other two.

In 1952–53 and 1953–54, the seed pieces in the furrow were treated with 15 lb. DDT or 10 lb. toxaphene in dusts, 0·98 lb. γ BHC in dusts and suspensions and 2·3 lb. aldrin or 0·32 lb. dieldrin in water emulsion per acre. All treatments except DDT increased germination, reduced termite damage during growth and increased the yield, but aldrin and dieldrin did so more than any other material and their value was confirmed by tests on standing infested cane and on seedlings. Attempts to prolong the period of protection given by BHC, DDT or toxaphene by a subsequent application of 0·98 lb. γ BHC per acre close to the clumps in a water suspension in July were unsuccessful. Parathion, which was applied at 1·2 lb. per acre with a subsequent BHC treatment, was ineffective.

STARKS (K. J.) & LILLY (J. H.). **Insecticide Seed Treatment of Soybeans in Relation to Phytotoxicity and Seed-corn Maggot Control.**—*J. econ. Ent.* **48** no. 5 pp. 538–543, 1 fig., 4 refs. Menasha, Wis., 1955.

The following is based on the authors' introduction and summary. Soy beans in the United States are occasionally damaged by *Hylemyia cilicrura* (Rond.) and other soil insects. Little is known of the protection afforded by treating the seed with insecticides, and various effective materials were therefore tested for seedling protection, phytotoxicity and compatibility with fungicide seed dressings and soy-bean bacterial inocula. Under greenhouse conditions, soy beans of five widely grown varieties showed no important differences in response to high dosages of BHC, none suffering large reductions in seedling emergence or mean green weight. In field tests, soy beans of high viability were not appreciably injured by emulsions containing Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate], recrystallised aldrin, heptachlor, dieldrin or lindane [almost pure γ BHC], applied at the rate of 1 oz. toxicant per bushel seed, and only slightly injured by 2 oz. doses of the same materials in wettable powders. However, 1·5 oz. of some of these in wettable powders severely damaged seed that was 19 months old. When soy beans 15 months old were treated with 4·5 oz. 50 per cent. captan [N-trichloromethyl thiotetrahydrophthalimide] per bushel and germinated in sand, the seedlings were stunted in growth and commonly had the seed coats adhering to the cotyledons for longer than normal. The addition of 4·5 oz. 25 per cent. γ BHC to the fungicide somewhat increased seed-coat adherence. Injury was mainly due to a reduction in seed viability and not to prolonged contact of the chemicals with the seed, since it occurred as readily with freshly treated seed as with seed treated and stored for six months. All the insecticides tested were compatible with captan, and the fungicide not only increased plant emergence in one field test but also showed some indication of reducing the injury caused by 1 oz. doses of insecticides, particularly Diazinon.

Heptachlor, toxaphene, γ BHC and dieldrin appeared to be compatible with inoculum of *Rhizobium leguminosarum* (a nitrogen-fixing bacterium) on the basis of yield. The insecticides were responsible, either directly or indirectly, for a small but significant increase in the iodine number of the soy-bean oil, γ BHC without inoculum causing the greatest increase. Diazinon, γ BHC and heptachlor applied to the seed gave increases in stand in a plot to which adults of *H. cilicrura* were attracted by an application of moistened fish meal, and 0·33, 0·66 and 1 oz. dosages were equally effective, alone or in combination with captan.

Stephen (W. P.). **Alfalfa Pollination in Manitoba.**—*J. econ. Ent.* **48** no. 5 pp. 543–548, 11 refs. Menasha, Wis., 1955.

The following is virtually the author's summary. The production of lucerne seed in Manitoba is most successful on land adjacent to uncultivated areas. The steady encroachment of agriculture into these semi-isolated areas has resulted in a progressive decrease in seed yields, until but a few of the areas that formerly gave high yields are productive. The elimination of the native bee fauna is the main cause of the decline, and management practices to maintain an optimum habitat for the principal pollinators are outlined.

Observations on plant preferences and tripping efficiencies of the native leaf-cutting bees (*Megachile* spp.) and bumble bees (*Bombus* spp.) indicate that there are marked differences in the abilities of the species to trip lucerne florets. Because of these differences, it is suggested that the term " wild bees " be supplanted by the names of the species involved whenever reference is made to their function in lucerne pollination.

Honey bees are of little importance in lucerne seed production in Manitoba, because of the abundance of sources from which pollen can be more readily obtained. They are not to be discounted as beneficial in general, but the regions in which they can be successfully employed are limited. Insects destructive to lucerne are less important in preventing seed production in Manitoba than in other lucerne areas; although species of *Adelphocoris*, *Lygus*, thrips and Aphids are present on the plants, little control is practised or required.

Starks (K. J.) & Lilly (J. H.). **Some Effects of Insecticide Seed Treatment on Dent Corn.**—*J. econ. Ent.* **48** no. 5 pp. 549–555, 4 graphs, 2 refs. Menasha, Wis., 1955.

The results are given of investigations to compare different methods of applying lindane [almost pure γ BHC] to maize seed to protect it from wireworms and other insects and to observe the phytotoxic and insecticidal effect of this and other seed treatments. The use of about 5 ml. 2·5 per cent. methyl-cellulose solution per lb. seed as an adhesive in modified slurry applications of dry γ BHC formulations was compared with that of 10·7 ml. acetone per lb. seed as a solvent of crystallised γ BHC, with four concentrations of insecticide combined with the fungicides, thiram [bis(dimethylthiocarbamyl)disulphide] or captan [N-trichloromethyl thiotetrahydrophthalimide], on two varieties of maize. On one, application in acetone solution progressively reduced both stand and yield as the dosage of γ BHC was increased, whereas methyl-cellulose treatment caused no reduction even at twice the standard dosage of γ BHC. On the other, γ BHC in acetone slightly reduced the stand but not the yield, and γ BHC with methyl cellulose gave favourable results even at high dosages. Neither the presence of a fungicide nor storage temperature had any appreciable influence on the stand of either variety.

There were no large or constant differences in plant emergence or average green weight of the plants when the seeds were treated by the slurry method or with the same quantity of dry γ BHC dust, either immediately or 14 months before sowing, but the slurry treatment reduced seedling injury at the higher dosages of γ BHC. In both treatments, the quantity of γ BHC had a significant effect, the higher doses (1 and 0·5 oz. γ BHC per bushel seed) causing marked shortening of the primary roots; the effect of added fungicide was variable. Seedlings that had appreciably low average green weights for the first nine days, due to seed treatment, sometimes outgrew

this difference later; the reduction in root length was not overcome, but the rate of growth of the root was normal after six days.

In a field test in cool, damp weather, captan was compatible with γ BHC, heptachlor and Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] at various dosages and increased the stands from seed treated with them. Seed treatment with γ BHC at two-thirds of the recommended dosage failed to protect maize seedlings from wireworms in an early planting in Iowa, but soil treatment with BHC, chlordane or aldrin two days before resowing with treated seed caused significant increases in stand and presumably reduced the number of active wireworms.

In laboratory tests, heptachlor, dieldrin and γ BHC protected germinating maize against larvae of *Melanotus communis* (Gylh.) at 1 oz. actual compound per bushel of seed and against the seed-eating Carabids, *Agonoderus comma* (F.) and *Clivina impressifrons* Lec., at 0·5 oz. per bushel. Diazinon killed about as many wireworms as the other insecticides, but failed to protect the seed satisfactorily. Toxaphene was only slightly effective against wireworms.

Poos (F. W.). **Studies of certain Species of** *Chaetocnema*.—*J. econ. Ent.* **48** no. 5 pp. 555–563, 9 figs., 5 refs. Menasha, Wis., 1955.

The bionomics of *Chaetocnema pulicaria* Melsh., *C. denticulata* (Ill.), *C. confinis* Crotch and *C. minuta* Melsh. were studied near Washington, D.C., in connection with investigations on the insect vectors of *Aplanobacter stewarti*, which causes bacterial wilt of maize [*cf.* R.A.E., A **29** 244, etc.]. *C. pulicaria*, the most efficient vector, passed through at least two overlapping generations a year and harboured the bacterium over winter. It was found developing on plants of 21 species, and maize, though a preferred food-plant, was not necessary for its survival in abundance. The adults overwintered in the top inch of soil, mainly under bluegrass [*Poa*], but also under orchard grass (*Dactylis glomerata*), redtop (*Agrostis alba*) or timothy (*Phleum pratense*) and were active during warm intervals. They became generally distributed in late April or early May and then congregated on maize seedlings, sometimes destroying them by skeletonising the leaves. The eggs are apparently laid at the base of maize or grass plants, and the young larvae are thought to feed on the fibrous roots. Adults of *C. denticulata* also overwintered in sod, sometimes more than two inches below the soil surface; this species was found developing on plants of 11 species, but preferred fall panicum (*Panicum dichotomiflorum*). Adults collected on maize in summer were found infected with *Aplanobacter*. *C. confinis* was abundant on maize growing near sweet potato or in fields containing convolvulaceous weeds, and *C. minuta* was found only occasionally. In the insectary, the egg, larval, prepupal and pupal stages and complete development lasted 4–10, 10–23, 1–5, 3–7 and 22–36 days, respectively, for *C. pulicaria* and 4–11, 10–21, 1–6, 3–8 and 24–31 days, for *C. denticulata*, the egg and larval stages lasted 3–14 and 5–18 days for small numbers of *C. confinis* and the egg, larval and pupal stages lasted 7, 11 and 6 days, respectively, for *C. minuta*. The only parasite reared was *Anaphoidea pullicrura* Gir., from eggs of *C. denticulata*.

In laboratory tests, hardly any adults of *C. pulicaria* survived temperatures of 0°F. or below, but the viability of *Aplanobacter* harboured by them was not affected by temperatures that proved fatal to the insects. The organism passed through the alimentary tracts of adults of *C. pulicaria* and *C. denticulata* in a viable condition; it was not cultured from eggs of the former or from adults reared on uninfected maize. Five species of

symptomless grasses growing near infected maize on which *C. pulicaria* had fed were found to harbour *A. stewarti* [*cf.* **28** 484].

In tests with organic insecticides, 4 per cent. DDT in an emulsion spray proved most effective against *C. pulicaria* and caused no injury to maize; 3–5 per cent. DDT dusts should also give adequate protection. Several applications, beginning when the maize is showing through the ground, are recommended as a means of preventing losses in small plantings either from direct attack by the insect or from bacterial wilt.

Dahms (R. G.), Sieglinger (J. B.) & Guthrie (W. D.). **Methods of treating Sorghum Selfing Bags for Insect Control.**—*J. econ. Ent.* **48** no. 5 pp. 568–572, 2 figs., 4 refs. Menasha, Wis., 1955.

The use of paper bags on sorghum heads to ensure self-fertilisation creates a favourable environment for *Aphis* (*Rhopalosiphum*) *maidis* Fitch and *Heliothis zea* (Boddie) (*armigera*, auct.), which often entirely destroy the grain. Several insecticides and methods of application for reducing the damage were tested in Oklahoma in 1948–52, the insecticides being applied in dusts or sprays to the sorghum heads, in dusts to the inside of the bags just before use, in emulsions in which the bags were soaked, or in emulsion concentrates painted in streaks 3–4 ins. long and 0·5 in. wide inside the bags by means of a brush. The bags remained on the heads for about 35–50 days, until the grain was mature.

Aldrin gave effective control of the two insects and did not cause sterility of the seed when applied as a dust or spray to the heads at 50 and 8 mg. toxicant per head, respectively, but not when applied to the bags in a dust at 50 mg. per bag, and a mixture of 200 mg. DDT and 20 mg. TEPP [tetraethyl pyrophosphate] per head in a spray was equally effective. No other insecticide applied to the heads was satisfactory, and several, notably BHC, caused sterility. When used to impregnate the bags immediately before use, emulsions containing 0·5 per cent. aldrin or heptachlor (at about 150 mg. toxicant per bag) or 1 per cent. DDT with 0·25 per cent. γ BHC (250–290 and 63–72 mg. per bag, respectively) gave good control of both insects and caused practically no sterility; other materials controlled only one insect or caused sterility. There was little loss in toxicity when the bags were not used for six months, and bags impregnated with 0·5 per cent. aldrin were still effective after 24 months.

Only aldrin was applied to the bags as a streak, and it gave better control by this method than by impregnation, being effective against both insects at 144 mg. toxicant per bag and against *Heliothis* at half that rate. As there was some difficulty in drying the bags when they were impregnated in bundles, the streak method was widely adopted in 1953.

Cox (J. A.). **Insecticides for Cherry Fruit Fly Control.**—*J. econ. Ent.* **48** no. 5 pp. 575–576. Menasha, Wis., 1955.

Rhagoletis fausta (O.-S.) and *R. cingulata* (Lw.) both attack cherries in Erie County, Pennsylvania, and damage has been unusually great in some orchards in recent years. Lead-arsenate sprays have not always given satisfactory control [*cf. R.A.E.*, A **37** 211], and some of the newer insecticides were tested in wettable powders in 1952–54. The two species are not differentiated in the results. In 1952, three applications of 1·5 lb. 15 per cent. parathion or 1 lb. 25 per cent. EPN [ethyl p-nitrophenyl thionobenzenephosphonate] per 100 U.S. gals. in June and July or two of 1 lb. 25 per

cent. dieldrin in June were more effective than two of 2 lb. lead arsenate; in 1953, substituting 1 5 lb. 15 per cent. parathion, 3 lb. 25 per cent. malathion or 1 lb. 25 per cent. EPN for lead arsenate in the second spray greatly reduced infestation; and in 1954, one application of lead arsenate followed by two of 4 lb. 25 per cent. malathion, 2 lb. 25 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate], 1 lb. 25 per cent. EPN or 1·5 lb. 15 per cent. parathion all gave good control.

In 1953 and 1954, single applications of phosphorus compounds were made while the fruits were known to be infested with eggs and larvae. Sprays of 1·5 lb. 15 per cent. parathion, 1 lb. 25 per cent. EPN or 2 lb. 25 per cent. Diazinon per 100 U.S. gals. gave complete control, but 3–4 lb. 25 per cent. malathion was less effective. In 1953, wettable powders containing 40 per cent. chlordane or 50 per cent. dieldrin, applied to the soil at the rate of 25 and 10 lb. per acre, respectively, in water, reduced the emergence of adults by 56 and 67 per cent., which is not considered sufficient.

Husain (S.) & Fisk (F. W.). **Comparison of certain organic Insecticides as Sprays or Baits against** *Blattella germanica* **(L.).**—*J. econ. Ent.* **48** no. 5 pp. 576–578, 2 figs., 8 refs. Menasha, Wis., 1955.

Adult females of *Blattella germanica* (L.) were used in tests designed to compare insecticides for use in sprays or baits for the control of *Schistocerca gregaria* (Forsk.) in Pakistan. The cockroaches were either sprayed and then kept for 72 hours in clean containers, or starved for 24 hours and then offered poisoned food for 72 hours in such a way that only their mouth-parts came into contact with it. Aldrin was the most toxic of the insecticides, with median lethal concentrations in spray and food of 0·004 and 0·005 per cent. The ratios of the median lethal concentrations of the other insecticides to those of aldrin in spray and (in brackets) food were 1·75 (1·8) for endrin, 1·75 (2·8) for dieldrin, 1·75 (4·6) for isodrin, and 4·2 (2·6) for heptachlor. The differences in ranking of the compounds, notably isodrin and heptachlor, in spray and food possibly indicate a difference in their effects on the attractiveness of the food. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] and Bayer L 13/59 [dimethyl 2,2,2-trichloro-1-hydroxyethylphosphonate] were also tested in the food, but were far less effective, the median lethal concentrations being 0·44 and 0·52 per cent.

Wilcox (J.) & Howland (A. F.). **Control of the Pea Leaf Miner in southern California.**—*J. econ. Ent.* **48** no. 5 pp. 579–581, 2 refs. Menasha, Wis., 1955.

The following is based on the authors' summary. In 1950, *Liriomyza langei* Frick appeared in injurious numbers on sugar beet in southern California, and field tests indicated that dusts of 10 or 20 per cent. toxaphene, 2·5 per cent. aldrin or dieldrin or 5 per cent. chlordane were only moderately effective against the adults. In experiments on infested spinach, lettuce (romaine) and table beet in 1951, 1–2 per cent. parathion dusts gave excellent reductions in the number of leaf mines when applied three times at weekly intervals at 15 lb. per acre and on the first two they gave good or excellent results when applied twice at 30 lb. per acre with a fortnight's interval. Dusts of 2–4 per cent. EPN [ethyl p-nitrophenyl thionobenzenephosphonate] or 2 per cent. Metacide [methyl-parathion and parathion] usually gave good control, but the numerous other dusts tested gave poor results and none of

the materials much reduced the number of punctures by the adults on the upper leaf surfaces.

Spinach leaves were sometimes severely scorched by the toxaphene, parathion and EPN dusts, and the last two caused more scorching of table beet when applied ten times at 10 lb. per acre at intervals of 3½ days than when applied five times at 20 lb. at intervals of a week.

Beet and spinach were also damaged by *Pegomyia hyoscyami* (Panz.), which was very well controlled by dusts of 1 per cent. parathion (alone or with 5 per cent. DDT), 2 per cent. EPN (alone or with 5 per cent. DDT), 4 per cent. NPD [tetra-n-propyl dithionopyrophosphate], 2 per cent. demeton [diethyl 2-(ethylmercapto)ethyl thiophosphate] or 5 per cent. DDT, and a 1·4 per cent. EPN spray was effective against both species.

Wilcox (J.) & Howland (A. F.). **Control of the Strawberry Aphid in southern California.**—*J. econ. Ent.* **48** no. 5 pp. 581–583, 1 ref. Menasha, Wis., 1955.

Capitophorus fragaefolii (Ckll.) is a serious pest of strawberry in southern California each year from February to April. Some 30 toxicants were tested against the Aphid in dusts or sprays in 1949–53, and the results obtained are shown in tables. Excellent control was given by six materials in dusts and by ten in sprays, but some of the phosphorus insecticides resulted in increases in *Steneotarsonemus* (*Tarsonemus*) *pallidus* (Banks), and most of the other effective materials were unsafe for use because of the danger of plant scorching or of poisonous residues. It is concluded that a 4 per cent. nicotine dust is the best treatment. It should be applied at about 50 lb. per acre when there are about five Aphids per leaflet and again a week later.

DeBach (P.). **Validity of the insecticidal Check Method as a Measure of the Effectiveness of natural Enemies of Diaspine Scale Insects.**—*J. econ. Ent.* **48** no. 5 pp. 584–588, 7 refs. Menasha, Wis., 1955.

Of the several methods in use in California to determine the effect of natural enemies in controlling insect pests of *Citrus* [*cf. R.A.E.*, A **36** 145; **38** 253; **40** 84], the insecticidal check method using DDT was shown by 1949 to be the easiest and most satisfactory in the case of *Aonidiella aurantii* (Mask.). However, it has been found that DDT may have a direct effect in increasing infestation by mites [*cf.* **41** 82; **43** 341], and tests were therefore carried out to determine whether it might have a similar action on *A. aurantii* and *A. citrina* (Coq.).

In February–September 1949, very light applications of a DDT spray once a month caused no increase and probably caused a decrease of *A. aurantii* on lemon in sleeve-cage tests, and similar treatments with DDT, DDD, methoxy-DDT (methoxychlor), toxaphene and BHC had the same effect when applied to whole trees on which natural enemies were not a factor, whereas in 1950, when *Aphytis lingnanensis* Comp. [*cf.* **44** 368] had been liberated in the grove and was vigorously attacking the scale, infestation became exceedingly heavy on a tree sprayed with DDT but remained low on an unsprayed one. Applications of low doses of DDT once a month from February to September 1951 to orange trees infested by *Aonidiella citrina* had no effect on scale populations in a grove from which parasites and predators were virtually absent, but caused a striking increase in one in which parasites, principally *Comperiella bifasciata* How. were abundant. It is concluded that DDT had no direct stimulating effect on the Coccids, and

that the increases were due to the reduction of their natural enemies by the DDT residues.

Wolfe (H. R.). **Relation of Leafhopper Nymphs to the Western X-Disease Virus.**—*J. econ. Ent.* **48** no. 5 pp. 588–590, 7 refs. Menasha, Wis., 1955.

The virus of western X-disease, which is of economic importance in peach and cherry in the United States, has been transmitted by adults of *Colladonus geminatus* (Van D.), *Scaphytopius acutus* (Say), *Fieberiella florii* (Stål) and *Keonolla confluens* (Uhl.) [*cf. R.A.E.*, A **42** 299], and tests to determine whether it could also be transmitted by nymphs of these Cicadellids were carried out in Washington State in 1952. In tests in which nymphs of *F. florii* fed on infected peach for 35 or 100 days in the first, second and third instars and on healthy peach seedlings in the third, fourth and fifth, the virus was transmitted by single nymphs in the third instar in three out of 19 tests, by single nymphs in the fourth instar in three out of 16 tests, and by nymphs in the third–fifth instars in each of two tests, but not in 15 tests with single fifth-instar nymphs. In 106 tests with *C. geminatus*, transmissions were obtained in two with nymphs that hatched from eggs deposited on infected material and that were transferred to test trees in the first–third and fourth instars and removed from them in the third–fifth and fifth, after 7–15 days. A few tests were made with nymphs of *K. confluens* and *S. acutus*, but no transmission was effected.

Nymphs of *C. geminatus* that acquired the virus during the first, second, first–third, second–fourth, third–fourth or fifth instars transmitted it after they reached the adult stage in 21 of 200 tests, and nymphs of *S. acutus* that acquired it during the fifth instar transmitted it as adults in three out of 50; no transmissions were obtained from adults of *K. confluens* that had fed on the source of virus as nymphs.

Waites (R. E.) & Van Middelem (C. H.). **Residue Studies of Toxaphene, Parathion and Malathion on some Florida Vegetables.**—*J. econ. Ent.* **48** no. 5 pp. 590–593, 4 refs. Menasha, Wis., 1955.

Investigations were carried out in Florida in 1952–53 to determine the amounts of residue left by insecticides widely used in the State on vegetable crops. Nine weekly applications of 1–2 lb. toxaphene per acre in wettable-powder or emulsion sprays and of 1·75–3·5 lb. in dusts resulted in residues of 0·72–5·72 parts per million 5–7 days after treatment on individual plots of tomato, four of similar toxaphene formulations in 0·49–1·88 p.p.m. four days after the third and 1·11–2·27 p.p.m. two days after the fourth application on blackeye southern cowpeas, and six applications of 0·15–0·4 lb. parathion per acre in dusts or wettable-powder or emulsion sprays in 0·18–0·32 p.p.m. residue on okra [*Hibiscus esculentus*] two days after the fifth and sixth applications, from which it appeared that the form in which the insecticide was applied had little effect on the amount of residue. Residues varied on different crops, but those for toxaphene were all below the Federal tolerance of 7 p.p.m. and did not seem excessively high in view of the short period of weathering before harvest. The very low residues on okra were partly due to rapid plant growth, and there is little possibility that residues from more than 1–2 applications would occur on marketable pods.

The residues on cabbage treated three times with 10·1, 20·2 or 30·3 oz. malathion per acre in emulsion sprays were 14·7, 45·7 and 91·3 p.p.m. four

hours after the last application, but were reduced by about 40 per cent. in 48 hours and by 80 per cent. in a week. Parathion and malathion, applied nine times at 4·4 and 16·66 oz. per acre, respectively, in emulsion sprays with or without DDT, gave residues of about 10–12 and 40 p.p.m. four hours after the last application, but these had decreased by 85 and 68 per cent. after three days and by 97 and 99 per cent. after seven, respectively. On turnip tops treated three times with 1·76, 2·4 and 4·8 oz. parathion per acre in wettable powders, the residues were 7·1, 15·1 and 31 p.p.m. four hours after the last treatment but were reduced by 70–85 per cent. after three days of weathering and by 90 per cent. after seven.

Medler (J. T.). **Meadow Spittlebug Control by Pre-emergence Treatment.** —*J. econ. Ent.* **48** no. 5 pp. 593–595, 6 refs. Menasha, Wis., 1955.

Investigations in lucerne fields in Wisconsin are described from which it is concluded that the egg masses of *Philaenus leucophthalmus* (L.) are laid in the stubble of the grain companion crop in first-year fields, but that in older fields with no stubble, irrespective of where they are laid (and no sites were discovered), the masses break up in winter, so that the eggs become scattered over the soil surface. In spring, the newly hatched nymphs move across the soil to reach the lucerne stems, on which they establish themselves. Tests on control in 1951 indicated that 1 lb. DDT or toxaphene or 0·25 lb. dieldrin per acre, applied to the soil in emulsion sprays, gave inadequate control when the plants were 1–3 inches tall and the eggs had not yet hatched, but were effective a fortnight later, after hatching. In 1953, granules containing 1·2 per cent. γ BHC, applied by aeroplane at the rate of 0·3 lb. γ isomer per acre on 12th May, a week before hatching, and 1 lb. methoxy-DDT (methoxychlor) in 4·5 U.S. gals. emulsion spray per acre, applied on 19th May, at hatching time, both gave promising results [*cf. R.A.E.*, A **41** 372]. In 1954, granules of BHC (1 per cent. γ isomer), applied by aeroplane at 30 lb. per acre before or at hatching time in various localities gave excellent control and were more effective than dieldrin or heptachlor in granules at the same rate.

Wene (G. P.). **Effect of some organic Insecticides on the Population Levels of the Serpentine Leaf Miner and its Parasites.**—*J. econ. Ent.* **48** no. 5 pp. 596–597, 3 refs. Menasha, Wis., 1955.

The leaf-mining Agromyzid, *Liriomyza subpusilla* (Frost), has recently become a major pest of peppers [*Capsicum*], cantaloupe melons, tomatos and cowpeas in parts of the United States, and insecticides applied for its control have affected its parasites [*cf. R.A.E.*, A **40** 84]. Experiments were therefore carried out in Texas in 1953–54 to determine the effect of some commonly used insecticides on populations of *L. subpusilla* and its parasites. Dusts were applied at 25 lb. per acre six times to cowpeas in March–May and four times to tomatos in April–May 1953 and sprays at 100 U.S. gals. per acre six times to cantaloupes and watermelons in March–April 1954, and leaf-miners and parasites, identified as *Diaulinopsis callichroma* Crwf., *Dacrostenus variipes* Crwf., *Opius dimidiatus* (Ashm.), *Zagrammosoma* sp. and an undescribed Cynipid, were reared from leaves collected in the four fields.

On cowpeas, host and parasite populations were greater on plants treated with 2·5 per cent. aldrin than on those receiving 5 per cent. DDT or no treatment, indicating that aldrin creates an environment favouring the

development of the *Liriomyza* population. DDT resulted in more hosts and fewer parasites than no treatment, and there was no leaf-shedding in untreated plots, indicating that parasites may control *Liriomyza* under natural conditions. On tomato, 5 per cent. DDT or DDD (TDE) resulted in more hosts and fewer parasites than no treatment, whereas 20 per cent. toxaphene, although reducing the parasites even more, also reduced *Liriomyza* slightly, indicating that it gave some control. On cantaloupe and watermelons, 0·25 lb. parathion per 100 U.S. gals. kept both host and parasites at a very low level, and sprays of 0·25 lb. lindane [almost pure γ BHC], 0·38 lb. dieldrin or (on cantaloupe only) 0·4 lb. endrin per 100 U.S. gals. tended to increase the *Liriomyza* population, probably by killing the parasites.

Glass (E. H.) & Fiori (B.). **Codling Moth Resistance to DDT in New York.** —*J. econ. Ent.* **48** no. 5 pp. 598–599, 4 refs. Menasha, Wis., 1955.

DDT gave adequate control of the codling moth [*Cydia pomonella* (L.)] on apple in an orchard near Lockport, New York, from 1946 to 1951, but not in 1952, and a spray of DDT and parathion applied on 16th June in 1953 failed to control the first generation, though a second cover spray of 2 lb. 50 per cent. DDT per 100 U.S. gals. a few days later prevented activity for about a week. For the rest of the season, sprays were applied whenever fresh larval activity indicated the need, applications being made seven times from 29th June to 27th August. Treatments with 2 or 3 lb. 50 per cent. DDT or 2·5 lb. Black Leaf 253 (a mixture of 25 per cent. DDT and 3 per cent. parathion) all resulted in much larger numbers of superficial injuries and larvae per 100 apples than was customary in the area, where 4–5 DDT cover sprays at fortnightly intervals normally gave almost complete control. In 1954, six cover sprays of 2 lb. 50 per cent. DDT or methoxy-DDT (methoxychlor) or 4 lb. 25 per cent. Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis-(p-chlorophenyl)-2-nitrobutane] per 100 U.S. gals. gave much less control at Lockport than five similar sprays at Geneva, where the original infestation was far heavier, but sprays of 3 lb. lead arsenate, 2 lb. 15 per cent. parathion and 2 lb. 25 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] per 100 U.S. gals. were effective in proportion to the original infestations in the two orchards.

Insectary tests of the ability of the newly hatched larvae to enter sprayed apples showed that 2 oz. 50 per cent. DDT per 100 U.S. gals. gave an average of 92 and 58 per cent. protection from the Geneva and Lockport strains, respectively. This difference in response is probably due to the development of resistance in the Lockport strain, but this is less than that reported from Ohio [*cf. R.A.E.*, A **42** 399].

Todd (E. L.). **The Separation of the Adults of *Acontia dacia* Druce from related Species.**—*J. econ. Ent.* **48** no. 5 pp. 599–600, 601, 9 figs., 2 refs. Menasha, Wis., 1955.

Acontia dacia Druce was found infesting cotton in Texas in 1953 and 1954 [*cf. R.A.E.*, A **43** 431] and was also taken in Louisiana in 1954. The author points out that another species of *Acontia* of nearly identical appearance, *A. terminimaculata* (Grote), also occurs in the eastern United States and probably in some of the cotton-growing districts, and describes wing characters distinguishing the two species from all other species of the genus

that occur in the United States and characters of the genitalia enabling them to be distinguished from each other. Their ranges are not known to overlap, except possibly in Louisiana.

Chiarelli de Gahan (A.) & Touron (E. A.). **Biología y taxonomía de** *Heliothis armigera* **(Hbn.).**—*Rev. Invest. agric.* **8** no. 2 pp. 111–148, 21 figs., 75 refs. Buenos Aires, 1954.

Todd (E. L.). **The Distribution and Nomenclature of the Corn Earworm.** —*J. econ. Ent.* **48** no. 5 pp. 600, 602–603, 4 figs., 5 refs. Menasha, Wis., 1955.

It is pointed out in the first paper that moths bred from larvae that seriously damage maize, flax, cotton, tobacco, sunflower, lucerne, tomato and other crops in Argentina have been variously identified at different times in that country and by workers in North America as *Heliothis armigera* (Hb.) and *Thyreion gelotopoeon* Dyar. The authors examined larvae and adults from laboratory cultures, specimens collected throughout Argentina and museum material from Argentina, Peru, the United States, Canada and South Africa; they illustrate this material and refer it to *H. armigera*,* of which they conclude that *T. gelotopoeon* is a synonym, the spinulation of the fore tibia, which was the character regarded as distinctive by Dyar in his description, which is reproduced, being variable [but see next paragraph]. An account is given of bionomical observations made in the laboratory in 1946–51 and begun with larvae taken on maize near Buenos Aires. There were three complete generations a year, with a partial fourth. The food-plants used were maize and pulses, and it was found that the males and females both lived for averages of eight days, that the females laid an average of 613 eggs each, that the egg and larval stages averaged three and 27 days, respectively, and that the pupal stage averaged 230 days for hibernating individuals and 22 days for the others. Under optimum conditions, the life-cycle was completed in a minimum of 28 days. Development was similar in the field.

In the second paper, the author refers to Common's discovery that the moth long known as *H. armigera* in the United States is not that species [*R.A.E.*, A **42** 420–421], but shows that *H. zea* (Boddie) is an earlier name than *H. umbrosa* Grote for it. Additional countries [*cf. loc. cit.*] from which *H. armigera* is recorded are Turkestan, China, Japan, Indo-China, Malaya, Indonesia, the Philippines and Guam. *H. zea* occurs throughout much of the New World; its range extends from the latitude of Saskatoon (Saskatchewan) to that of Montevideo (Uruguay) and it is also present in Hawaii, having presumably been introduced from North America. From an examination of the type series of *T. gelotopoeon* from Tucumán and La Rioja (Argentina), and specimens of this species from Rio Grande do Sul (Brazil), Montevideo (Uruguay), Guairá (Paraguay), Peru, Tucumán, and Santiago (Chile), he concludes that it is distinct from *H. zea*, differing from it in characters of the male genitalia that are described and illustrated. On the basis of the structure of the male genitalia and the head, *T. gelotopoeon* is transferred to the genus *Heliothis*. The value of the spinulation of the fore tibia as a specific character in separating the two species is discussed, and it is shown that although specimens with three or more spines on the outer margin may safely be identified as *H. gelotopoeon*, other means are required to identify those with less than three spines, from the area in which

* The figures of genitalia given in this paper and attributed by the authors to *H. armigera* include one of the aedeagus. The aedeagus figured resembles that of *H. zea* (Boddie), and not that of *gelotopoeon*, as illustrated in the second paper.—*Ed.*

both species are known to be present. The genitalia serve to differentiate the males, but there is no reliable character in the case of the females.

Robertson (R. L.) & Arant (F. S.). **Effect of Bayer 17147 on Boll Weevil.** —*J. econ. Ent.* **48** no. 5 pp. 604–605. Menasha, Wis., 1955.

Experiments were carried out in Alabama in 1954 to compare 5 per cent. Bayer 17147 [O,O-dimethyl S-(4-oxo-benzotriazino-3-methyl) phosphorodithioate] with 20 per cent. toxaphene in dusts for the control of *Anthonomus grandis* Boh. [*cf. R.A.E.*, A **44** 166]. When cotton plants were dusted in the field, and adults exposed on leaves from them immediately afterwards in the laboratory, 10 and 20 lb. Bayer dust per acre caused 76 and 100 per cent. mortality in four hours and complete kill in 24 hours, whereas 10 and 20 lb. toxaphene dust resulted in no mortality in four hours, 12 and 22 per cent. in 24 hours and 50 and 64 per cent. in 72 hours. When the leaves were exposed to the weevils after various periods of weathering, 10 lb. Bayer dust still gave complete mortality after ten days of weathering and 20 lb. after 12 days, whereas 10 and 20 lb. toxaphene dust gave only 92 and 94 per cent. mortality after two days of weathering and had no significant effect after ten days.

Fahey (J. E.), Brindley (T. A.) & Spear (M. L.). **DDT Residues in Fat from Steers pastured on Corn Stover in DDT-treated Fields.**—*J. econ. Ent.* **48** no. 5 pp. 606–607, 4 refs. Menasha, Wis., 1955.

Farmers in the maize belt of the United States commonly allow cattle to feed in maize fields after harvest until the food supply is exhausted, and as spraying the plants with DDT for the control of *Pyrausta nubilalis* (Hb.) leaves appreciable residues on the plants, tests were made to determine whether the cattle would accumulate a measurable quantity of DDT in their fat tissue and, if so, how long this would persist after the animals were returned to a diet free of DDT. One maize field was treated with 1·5 lb. technical DDT in 10 U.S. gals. emulsion spray per acre on 25th June and 2nd July, and plant samples collected for analysis on 2nd July, 10th August, 23rd September and 14th October showed 116·7, 14·4, 11·2 and 23·3 parts per million DDT, respectively; the higher proportion on the last date is attributed to a decrease in moisture content of the plant remains. Similar samples from an untreated field contained no DDT. Steers that weighed 786–884 lb. each and showed no DDT in the loin fat on 12th October were allowed to feed in the treated field from 19th October to 21st December, after which they received a diet free from DDT. Fat samples taken on 20th November, 21st December and 22nd March contained 1–2·8, 5 and 0·1 or less p.p.m. DDT, respectively, and examination of 10-gm. samples of fat from an animal slaughtered on 2nd April indicated that some of them might contain as much as 0·1 p.p.m. However, no DDT could be found in 50-gm. samples, though less than 0·1 p.p.m. of DDT degradation products was present. Animals fed in the untreated field showed no measurable quantity of DDT at any time.

Frick (K. E.) & Bry (R. E.). **Dormant vs. Summer Control of the Grape Mealybug in the Yakima Valley.**—*J. econ. Ent.* **48** no. 5 pp. 607–608. 3 refs. Menasha, Wis., 1955.

Infestations of vines by *Pseudococcus maritimus* (Ehrh.) disappear within a year from some vineyards in the Yakima Valley of Washington owing to

the activity of natural enemies, but persist in others, and control measures are therefore sometimes necessary. A summer spray of 1 lb. 25 per cent. parathion per 100 U.S. gals. is effective [*cf. R.A.E.*, A **40** 244], but must not be applied until some honeydew appears, for proper timing, so that the presence of a certain amount of sooty mould on the grapes at harvest cannot be prevented. Delayed-dormant and summer treatments were therefore compared in a heavily infested vineyard in 1954. An emulsion spray of 0·5 lb. parathion per 100 U.S. gals. applied on 19th April resulted in 6, 4·5 and 1·5 per cent. bunches contaminated with honeydew on 10th August, 14th September and 28th September, before harvest, as compared with 68, 4·5 and 0 per cent. for a spray of 1 lb. 25 per cent. wettable parathion per 100 U.S. gals. applied on 10th or 11th August; 0·25 and 3·75 per cent., respectively, of the bunches on plants receiving the two treatments showed dry sooty mould on 28th September. An earlier application of the summer spray, when the first honeydew was deposited, would probably have reduced the amount of sooty mould at harvest. Both treatments gave satisfactory control of the mealybug, but the delayed-dormant application is to be preferred.

Gallun (R. L.). **Races of Hessian Fly.**—*J. econ. Ent.* **48** no. 5 pp. 608–609, 4 refs. Menasha, Wis., 1955.

Crop-improvement programmes in parts of the United States in which winter wheat is grown sometimes include breeding for resistance to *Mayetiola* (*Phytophaga*) *destructor* (Say), and it is therefore important to understand the genetic factors controlling the ability of races of this Cecidomyiid to infest and develop on different winter-wheat varieties. The author reports that three races, each able to infest certain wheats differing in the genes controlling resistance to the fly, have been developed at Lafayette, Indiana [*cf. R.A.E.*, A **38** 400]. No morphological differences between the adults have been found. Each race was selected from a locally reared population and inbred for six or more generations on wheat varieties representing specific types of resistance to the majority of the native fly population. Extensive studies are being carried out to determine to what extent hybrid races will develop on wheat varieties with particular types of resistance, the number of genes controlling the ability of each race to infest all representative wheat varieties, and the composition of various regional fly populations. Some of the preliminary results are described.

Hensley (S. D.) & Arbuthnot (K. D.). *Diatraea grandiosella* **Dyar as a Host of** *Chelonus annulipes* **Wesm.**—*J. econ. Ent.* **48** no. 5 pp. 611–612, 5 refs. Menasha, Wis., 1955.

An account is given of experiments in Oklahoma in 1954 in which *Chelonus annulipes* Wesm., an introduced parasite of *Pyrausta nubilalis* (Hb.) [*cf. R.A.E.*, A **20** 477], successfully parasitised *Diatraea grandiosella* Dyar in the laboratory. Egg masses of *Diatraea* were exposed to oviposition by females of the Braconid that alighted and searched over pieces of green maize stem, and transferred to the whorls of young maize plants in the greenhouse. The *Diatraea* larvae were removed from the plants 16 days later, on 2nd August, and isolated with sections of green maize stem. Of the 11 recovered, eight appeared to be stunted and, from these, two parasite larvae issued on 4th August, two on 5th August and one on 7th August. The first two parasites died without pupating, the second two gave rise to normal males and the last pupated but did not transform to the adult. The other three stunted borers died on 5th August, and third-instar larvae of *Chelonus* were found in two of

them. The behaviour of the adult parasites in the act of ovipositing and the effects of parasitism on the host were very similar to those described for *P. nubilalis*.

LANGE jr. (W. H.). *Aceria tulipae* (K.) **damaging Garlic in California.**—*J. econ. Ent.* **48** no. 5 pp. 612–613, 1 fig., 4 refs. Menasha, Wis., 1955.

Aceria tulipae (Keifer) was found in California in April 1954 infesting stored garlic bulbs, on which the mites concentrated particularly on the green growing tip and to some extent between the bracts; infested bulbs tended to decompose. The infestation persisted when the bulbs were planted and the foliage showed virus-like symptoms [*cf. R.A.E.*, A **43** 270].

The mites later moved up into the folds of the leaves to continue feeding, but this and a later spread to adjacent plants did not seem to cause much damage. The mite is probably widespread in garlic-growing areas in California, and late varieties tend to be more damaged than early ones. *A. tulipae* was found in association with *Rhizoglyphus callae* Oudm. and *Glycyphagus domesticus* (Deg.) on the stored bulbs and with the first in the field.

Uninfested bulbs stored with infested ones at 68°F. showed 1–1,285 mites per bulb after 90 days, whereas bulbs stored in the same way, but dusted with sulphur, had 0–1. Fumigation with 2·5 lb. methyl bromide per 1,000 cu. ft. for two hours at 80°F. gave complete control, with no damage to the bulbs, and presumably affected the eggs, as the mites did not reappear. Control of the mites on the planting stock appears at present to be the most desirable measure; dusting with sulphur or a mixture of sulphur and DDT should afford control in the field, but the mites are difficult to reach once they are concealed in the folds of the leaves.

HARRIES (F. H.) & MATSUMORI (H.). **Insecticide Tests on the Squash Bug.**—*J. econ. Ent.* **48** no. 5 pp. 613–614, 10 refs. Menasha, Wis., 1955.

In laboratory tests carried out in Ohio in 1952, all adults of *Anasa tristis* (Deg.) confined on deposits of less than 0·275 mg. per sq. cm. of dusts containing 5 per cent. malathion or 2 per cent. dieldrin, endrin, isodrin, NPD [tetra-n-propyl dithionopyrophosphate] or EPN [ethyl p-nitrophenyl thionobenzenephosphonate] and 67 per cent. of those similarly exposed to 2 per cent. aldrin died in 24 hours, whereas there was no mortality in the controls. Similar tests with lighter deposits indicated that parathion, malathion, EPN and dieldrin were the most effective materials. In a field test on gourds heavily infested with large nymphs and adults, 19·2, 20·8 and 4 living and 33·5, 2·7 and 27·5 dead bugs per 5 feet of row were collected 24 hours after dusting with 41 lb. 5 per cent. malathion, 48 lb. 2 per cent. A-42 (arsenomethane As-1,2-disulphide) and 52 lb. 2 per cent. parathion per acre, respectively, and 4·8 and 8 living and 19 and 18·2 dead ones after spraying with 2 lb. aldrin or chlordane in 100 U.S. gals. per acre, as compared with 40·8 living and 1·8 dead for no treatment. It is concluded that parathion and malathion are toxic to *A. tristis* and A-42 repellent.

HARRIES (F. H.) & VALCARCE (A. C.). **Laboratory Tests of the Effect of Insecticides on some beneficial Insects.**—*J. econ. Ent.* **48** no. 5 p. 614, 1 ref. Menasha, Wis., 1955.

The predacious insects, *Collops vittatus* (Say), *Hippodamia convergens* (Guér.) and *Ceratomegilla* (*Coleomegilla*) *maculata* (Deg.), are common in

the Phoenix area of Arizona and often abundant on crops treated with insecticides. The first sometimes occurs in large numbers on cantaloupe melons infested by mites, and all three on lucerne heavily attacked by *Myzocallis ononidis* (Kalt.) (*trifolii* (Monell)). Since they may be affected by insecticidal treatments, laboratory tests were made on the toxicity of some of the commoner insecticides to them. The predators were kept on dusted sugar-beet plants at about 75–80°F. for 24 hours and then examined for mortality; twice as much dust was used for *Collops* as for the Coccinellids. Dusts containing 5 per cent. malathion or Chlorthion [O,O-dimethyl O-3-chloro-4-nitrophenyl thiophosphate], 4 per cent. Diazinon [O,O-diethyl O-2-isopropyl-4-methyl-6-pyrimidinyl thiophosphate] or 2 per cent. parathion caused most mortality, but less of *Collops* than of the other species, to which they were significantly more toxic than the other materials tested; 5 per cent. Perthane [1,1-bis(p-ethylphenyl)-2,2-dichloroethane (ethyl-DDD)] or Strobane [a chlorinated mixture of α-pinene isomers with a chlorine content of about 66 per cent.] or 1 per cent. endrin had no significant effect on any of the insects, 5 per cent. DDT, 10 per cent. toxaphene and 2 per cent. dieldrin none on *Hippodamia* and the last none on *Ceratomegilla;* 2·5 per cent. heptachlor showed slight toxicity to all three.

Dickson (R. C.) & Fleschner (C. A.). **Homopterous Insects attacking Avocado in Central America and Mexico.**—*J. econ. Ent.* **48** no. 5 pp. 614–615, 1 ref. Menasha, Wis., 1955.

Between November 1953 and February 1954, 51 species of Homoptera were collected on wild or cultivated avocado in the areas in Central America and Mexico in which this tree is indigenous. They included 18 Coccids, most of which seemed to be effectively controlled by natural enemies, though *Chrysomphalus ficus* Ashm. was injurious in one place in Honduras, where it appeared to be a recent introduction, and smaller numbers of several other families, of which only the Membracid, *Metcalfiella monogramma* (Germ.), in Mexico, an apparently undescribed Cicadellid of the genus *Idona* in Mexico and Honduras, and the Psyllid, *Trioza anceps* Tuthill, were injurious.

Mistric jr. (W. J.). **The Toxicity of certain organic Insecticides to the Sweetpotato Weevil.**—*J. econ. Ent.* **48** no. 5 pp. 615–616, 3 refs. Menasha, Wis., 1955.

In view of the desirability of controlling *Cylas formicarius elegantulus* (Summers) in seed beds and field plantings of sweet potato in Texas, tests were carried out in 1954 on the toxicity of synthetic organic insecticides to adults of that weevil. Emulsion sprays or dusts of several chlorinated hydrocarbons and phosphorus compounds were applied to cut sweet-potato disks partly buried in damp soil in dishes at rates equivalent to 0·5 lb. toxicant per acre, and adult weevils were confined with them 30 minutes later. Dusts of endrin, methyl-parathion and EPN [ethyl p-nitrophenyl thionobenzenephosphonate] gave 99, 92 and 89 per cent. control in 48 hours, and sprays of these materials and malathion gave 73, 79, 78 and 79 per cent., respectively, whereas a malathion dust or dieldrin, lindane [almost pure γ BHC], aldrin, heptachlor, DDT, chlordane or toxaphene in sprays and dusts were much less effective.

Jones (S. C.) & Wallace (L.). **Cherry Fruit Fly Dispersion Studies.**—*J. econ. Ent.* **48** no. 5 pp. 616–617. Menasha, Wis., 1955.

Investigations in Oregon in 1950 showed that radioactive phosphoric acid could be combined with sucrose as a food for adults of *Rhagoletis cingulata* (Lw.) without shortening their life. The flies ingested the food readily, and those with an initial radioactivity of 6,000 counts per minute could be detected for six weeks with a portable survey meter. There were considerable variations in the amount of radioactivity retained by individual flies, but 80 selected at random after feeding on radioactive sucrose for 2–4 days showed an average of 8,893 counts per minute. Females that received heavy dosages of radioactive phosphoric acid failed to oviposit in cherries, and their excreta and the juice and pulp of the cherries caged with them became radioactive. On 16th July 1951, 2,010 radioactive adults were released in a cherry orchard, and captures in traps containing ammonium carbonate, with an insect net or under trees sprayed with nicotine sulphate were made until 9th August. In all, 39 radioactive individuals were recovered, including 14 from the point of release, seven 205 ft. away and one each 555 and 942 ft. away; one was taken in another cherry orchard on the far side of a beet field, 560 ft. from the point of release.

Jones (S. C.). **Fumigation Tests with Ethylene Dibromide for the Control of Cherry Fruit Fly Eggs, Larvae and Puparia.**—*J. econ. Ent.* **48** no. 5 pp. 617–618, 1 ref. Menasha, Wis., 1955.

Since fumigation with methyl bromide gives complete mortality of the immature stages of *Rhagoletis cingulata* (Lw.) in cherries only when heavy dosages and long exposures are used [*cf. R.A.E.*, A **42** 168], ethylene dibromide was tested in 1953–54 in Oregon. Treatment with 0·5 lb. ethylene dibromide per 1,000 cu. ft. for two hours at 70–73°F. killed all eggs, larvae and pupae, but a few adults emerged from puparia treated with 0·25 lb. for two hours. There was a slight change of flavour in the cherries four days after treatment with 0·5 lb. ethylene dibromide for two hours, and a definite deterioration after the use of more than 1 lb. ethylene dibromide per 1,000 cu. ft.

Pfrimmer (T. R.). **Response of Insects to three Sources of Black Light.**—*J. econ. Ent.* **48** no. 5 p. 619. Menasha, Wis., 1955.

Tests were made in Texas in 1954 of the attractiveness to insects of three sources of ultraviolet light. These were a 15-watt BL fluorescent lamp, a 15-watt BLB fluorescent lamp, and three 2-watt S14AR-1 argon glow lamps, for which the relative amounts of radiant energy were 1,800, 1,350 and 7 (measured in fluorens) in the ultraviolet region (2,800–3,800 Å) and 145·4, 0·057 and 0·06 (measured in lumens) in the visible region (3,800–7,600 Å); all had radiation peaks of 3,500–3,600 Å and were turned on at 5 p.m. and off at 8 a.m. On 11 nights in January, 13 in February and 18 in March, the BLB trap caught twice as many insects as the BL trap and about 12·5 times as many as the argon trap; some of the variation may have been due to the difference in reflection from aluminium and galvanised sheet metal in the different traps, but the smallness of the catch in the argon trap was probably due largely to the much lower intensity of radiation. Coleoptera, Diptera, Lepidoptera and Ephemeroptera made up about 95 per cent. of the total in each trap, the first being most numerous in the BL and BLB traps and the Diptera in the argon trap. The proportion of Coleoptera and Ephemeroptera to the other Orders decreased and that of the Diptera and Lepidoptera increased as ultraviolet output decreased. Although the BLB

lamp attracted nearly 2·5 times as many Lepidoptera as the BL lamp, the response of individual species varied a great deal, so that each species or group of species requires extensive study to determine the most efficient and economical light source and trap design for it [*cf. R.A.E.*, A **44** 120, etc.].

TURNIPSEED (G. F.) & MITCHELL (T. B.). **The Apple Seed Chalcid, its Distribution and Potentials as a Pest of Apples in North Carolina.**—*J. econ. Ent.* **48** no. 5 pp. 620–621, 1 ref. Menasha, Wis., 1955.

A survey of 42 apple orchards in North Carolina in the autumn of 1954 showed that *Torymus druparum* Boh. [*cf. R.A.E.*, A **5** 122] was present in 18, of which 15 had been treated with lead arsenate and one with parathion. Infestation was moderately heavy in the north-west and light in the east. The fruits grew little after eggs had been deposited in them, though they remained on the tree and ripened. There was little effect on total yield, owing to the heavy set of fruit, but loss might result in other years.

DOMINICK (C. B.). **Further Experiments with Insecticides for Control of Green June Beetle Larvae.**—*J. econ. Ent.* **48** no. 5 pp. 621–622, 2 refs. Menasha, Wis., 1955.

In further tests on the control of *Cotinis nitida* (L.) in tobacco seed beds in Virginia [*cf. R.A.E.*, A **39** 10], tobacco was sown during February and treatments were applied to the soil surface in the late afternoon on warm days when the larvae were active. Insecticides used as drenches were applied at the rate of 50 U.S. gals. per 100 sq. yards, dusts were mixed with a little moist sand (to prevent drift) and applied by hand at 2 lb. per 100 sq. yards, granules were applied at 2 lb. per 100 sq. yards unless otherwise stated and the plots were examined for dead larvae at two-day intervals until the final results were determined by examining the soil for living and dead larvae. In 1952, when treatments were made on 10th April and the final results determined on 1st May, 1 per cent. parathion dust and 15 per cent. wettable-parathion drench caused 96 and 91 per cent. reduction in numbers of living larvae, 1·5 per cent. lindane [almost pure γ BHC] and 1 per cent. Potasan [O,O-diethyl O-7-hydroxy-4-methyl-coumaryl thiophosphate] in dusts caused 87 and 62 per cent., and 5 per cent. malathion and 1 per cent. demeton [diethyl 2-(ethylmercapto)ethyl thiophosphate] also in dusts resulted in negligible reductions. In 1953, applications on 10th April of 1 per cent. parathion in dust or granules, 1 per cent. γ BHC in dust or granules, 5 per cent. Dilan [a 1:2 mixture of 1,1-bis(p-chlorophenyl)-2-nitropropane and 1,1-bis-(p-chlorophenyl)-2-nitrobutane] in dust and 5 per cent. chlordane in granules at 5 lb. per 100 sq. yards resulted in 98, 96, 92, 94, 92 and 75 per cent. reduction, respectively, by 10th May, and in 1954, applications on 7th April of 1 per cent. γ BHC or parathion or 5 per cent. Dilan in dusts caused 94, 94 and 77 per cent. reduction and applications of 15 per cent. wettable parathion, 50 per cent. wettable Dilan and 25 per cent. wettable malathion in drenches caused 97, 90 and 86 per cent. reduction by 1st May. Parathion gave the most rapid control, and only lindane and chlordane caused any injury to the seedlings.

MILLER (W. E.). **Biology of *Anacampsis innocuella* (Zeller), a Leafroller on Aspen.**—*J. econ. Ent.* **48** no. 5 pp. 622–623, 1 fig., 5 refs. Menasha, Wis., 1955.

Larvae found in large numbers rolling the leaves of a stand of 30 aspen trees (*Populus grandidentata*) up to 15–20 years of age in north-eastern

Ohio in 1952 were identified as *Anacampsis innocuella* (Zell.). Occasional observations in 1952–53 showed that the larvae began to feed in April, as soon as the leaves appeared. Pupae were observed in the rolled leaves towards the end of May, and adults began to emerge in mid-June. It seemed likely that the eggs are deposited on the twigs in the summer and overwinter before hatching. The parasites observed included *Spilochalcis flavopicta* (Cress.) and *Dimmockia incongrua* (Ashm.), which emerged from the pupae; 11 per cent. of the larvae and pupae were parasitised. Similar, but lighter, attacks were observed in two other places in northern Ohio.

Shands (W. A.), Simpson (G. W.) & Covell (M.). **Aphids caught in Wind-vane Traps with Openings of different Sizes.**—*J. econ. Ent.* **48** no. 5 pp. 624–625, 1 ref. Menasha, Wis., 1955.

In tests in Maine to determine whether the openings of wind-vane traps used for studies of Aphids that infest potatoes could be reduced in size during periods of heavy flight and the results adjusted without appreciable bias, two traps of the same design but with openings 19·5 and 12 ins. square were operated from 22nd August to 28th September 1945. Of the three potato-infesting species taken, the buckthorn Aphid, *Aphis abbreviata* Patch [which Börner (1952) tentatively considered a synonym of *A. nasturtii* Kalt. (*rhamni*, auct.) (*cf. R.A.E.*, A **29** 188; **43** 281)], was the most numerous, followed by *Myzus persicae* (Sulz.) and *Macrosiphum solanifolii* (Ashm.). Analyses of the catches in the two traps indicated that the one with the smaller aperture retained the Aphids better than the other, and that, for the purpose of converting total catches and catches of individual species in it to the normal trap basis, a factor of 2·64 (the ratio of the areas of the aperture) was less satisfactory, because of daily variations in catch, than one of 2·19 (the mean ratio of the catch of *A. abbreviata* and also of all Aphids in the trap with the larger opening to that in the other one before any of the species became scarce).

Weaver (N.) & Garner (C. F.). **Control of Insects on Hairy Vetch.**—*J. econ. Ent.* **48** no. 5 pp. 625–626. Menasha, Wis., 1955.

Two field experiments were carried out in Texas in 1954 to find methods of controlling injurious insects on hairy vetch [*Vicia villosa*] without harming insect pollinators; *Macrosiphum pisi* (Harris) and species of *Lygus*, principally *L. lineolaris* (P. de B.), were the only pests that were numerous. Demeton [diethyl 2-(ethylmercapto)ethyl thiophosphate] was applied in low-volume sprays with 2 lb. toxaphene per acre in April or May and gave good control of the Aphid for two weeks and barely adequate control for three weeks at 1 oz. per acre, good control for three weeks and adequate control for four at 2 oz., and good control for four weeks and adequate control for five at 4 oz., and it is concluded that 2 oz. demeton would give seasonal control in an average year if applied immediately before flowering. The results against *Lygus* supported those obtained in 1953 and indicated that these bugs could be controlled adequately for the season with a single insecticide treatment, provided that it is applied before there are many adults; the tests in 1953 indicated that demeton alone would give partial control of the nymphs. None of the treatments caused a significant increase in seed yield. In the observations on pollinators, demeton proved highly toxic to honey bees sprayed with it, but foraging bees captured in treated plots lived as long as those from other fields. There was no indication that pre-blossom applications were injurious to them in any way, and it is concluded that a single spray of toxaphene and demeton applied before the vetch begins to bloom heavily is a promising treatment.

McGough (J. M.) & Noble (L. W.). **Colonization of imported Pink Bollworm Parasites.**—*J. econ. Ent.* **48** no. 5 pp. 626–627, 1 ref. Menasha, Wis., 1955.

Liberations of introduced parasites for the control of *Platyedra* (*Pectinophora*) *gossypiella* (Saund.) on cotton [*cf. R.A.E.*, A **26** 275] were continued in 1937–44 and 1953–54. Those released in 1937–44 comprised *Bracon kirkpatricki* (Wlkn.), *B. mellitor* Say, *B. nigrorufum* (Cushm.), *Chelonus blackburni* Cam., and *C. pectinophorae* Cushm. in Texas, *B. nigrorufum* and *C. blackburni* in Mexico and *Ephialtes* (*Exeristes*) *roborator* (F.) in Porto Rico, the numbers concerned and the places of origin being shown in a table. All were recovered in the field during the season of release and, with the exception of *B. kirkpatricki*, overwintered in cages, but none became established. In 1953–54, five other Braconids, all from India, were released in Texas and four of them in Mexico. They were not subsequently recovered, but the samples of bolls collected for rearing are considered to have been too small to indicate whether any of them might have maintained itself at a low population level.

Smith (F. F.). **Notes on the Biology and Control of** *Pseudocneorhinus bifasciatus*.—*J. econ. Ent.* **48** no. 5 pp. 628–629, 8 refs. Menasha, Wis., 1955.

Moderate or severe damage was caused by *Pseudocneorhinus bifasciatus* Roel. to various ornamental plants at College Park and Beltsville, Maryland, and Washington, D.C., in 1953 and 1954 [*cf. R.A.E.*, A **38** 250, etc.]. Adults were observed on 7th June, and some lived until 10th November in cages. In laboratory tests, dusts of 1 per cent. dieldrin or 2·5 per cent. aldrin, heptachlor, chlordane, isodrin, malathion or parathion in pyrophyllite, gave complete kill of adults on azalea in 8–12 days, the first preventing all feeding and the remainder permitting slight to moderate feeding for 4–6 days; 1 per cent. aldrin or chlordane gave high but incomplete mortality, and 10 per cent. DDT, toxaphene or methoxy-DDT (methoxychlor) and 2·5 per cent. endrin or lindane [almost pure γ BHC] were ineffective. In field tests, dusts of 5 per cent. heptachlor or 2·5 per cent. aldrin killed the adults, but the infestation reappeared in 1954 after treatment in August 1953, indicating that control earlier in the season is necessary to prevent oviposition.

Deonier (C. E.). **Penetration of the Foliage Canopy of Corn and Potatoes by Aerial Spray.**—*J. econ. Ent.* **48** no. 5 p. 629, 1 ref. Menasha, Wis., 1955.

Tests were made in 1954 on sweet maize in Washington and on potato in California to determine how much of a spray applied by aeroplane penetrates downward through the foliage canopy, since sprays must reach the silks of maize to control *Heliothis zea* (Boddie) (*armigera*, auct.), and the hill and furrow levels in potato fields to control *Myzus persicae* (Sulz.). Sprays of water containing a dye were applied by an aeroplane with 59 open-cone nozzles 0·125 inch in diameter placed 4 ins. apart, flying 2 ft. above the tops of the maize and 4–5 ft. above those of the potatoes, and measurement of deposits on steel plates exposed in various positions showed that 58 and 89 per cent. less spray reached the silks and the ground than the tassels of maize and that 63 and 69 per cent. less reached the hill

and furrow levels than the tops of the potato plants. The effective insecticide coverage for the control of Aphids on potatoes is much less than that indicated by these figures, since most of the spray reaching the lower leaves is deposited on the upper surface, whereas the Aphids are on the undersides.

PERETZ (I.) & AVIGDOROV (A.). **Experiments on the Control of the Tropical Fig Borer in Israel.**—*FAO Plant Prot. Bull.* **4** no. 9 pp. 132–135, 1 ref. Rome, 1956.

Since its recent discovery in Israel [*cf. R.A.E.*, A **41** 218], *Batocera rufomaculata* (Deg.) has spread rapidly throughout the northern and central regions of the country and in the past six years has destroyed over half the fig trees in several areas. In view of its increasing importance, experiments on the prevention and control of infestation were begun in 1955. As a protective measure, the lower parts of the trunks of uninfested trees growing among infested ones were painted with a wax preparation containing 2·5 per cent. parathion, this toxicant having proved harmless to the trees and toxic to the larvae in laboratory tests. At the end of the season, only 5 of 506 trees treated in this way had become infested, as compared with 110 of 369 left untreated. For local treatment of infested trees, areas of the bark beneath which young larvae were situated were painted with the preparation. About 95 per cent. mortality was obtained in 10–15 days. When various liquids were injected into the burrows of older larvae that had already entered the wood, only benzine gave high mortality without injuring the trees.

It is concluded that adequate protection can be obtained by impregnating the trunks with parathion, but that the possibility of translocation of the poison in the sap and penetration into the figs should be investigated, together with possible phytotoxic effects resulting from repeated annual applications. The quantity of parathion required for local bark treatment is too small to create such dangers, and this method is recommended against young larvae. The injection of benzine should be regarded as complementary to the other measures, as the main damage has already occurred when the larvae have entered the wood.

Outbreaks and new Records.—*FAO Plant Prot. Bull.* **4** no. 8 p. 124; no. 9 pp. 140–142. Rome, 1956.

J. B. H. Lejeune reports (p. 124) that the Bostrychid, *Apate indistincta* Murray, was observed for the first time in Ethiopia in May 1955, attacking coffee trees in the Province of Shoa. Further investigations showed it to be fairly common in the area. The insect is known from other parts of East Africa and damages the trees by boring in the adult stage up the trunks and branches.

It is reported by the Belgian Ministry of Agriculture (p. 124) that three outbreaks of *Ceratitis capitata* (Wied.) were discovered near Brussels in 1955, the fruits attacked being peaches and pears. *C. capitata* was first recorded in the field in Belgium in 1952 [*R.A.E.*, A **43** 387], but did not survive the winter.

The U.S. Department of Agriculture reports (p. 140) that incipient infestation by *C. capitata* was discovered in April 1956 in a newly developed residential suburb of Miami, Florida, and subsequently in the adjacent Broward County. Immediate steps were taken to prevent the movement from the infested area of any plant material likely to harbour the fruit-fly, and all fruits in which the larvae can develop were removed and destroyed.

Quarantine regulations were imposed, and it is hoped to eradicate the infestation. *C. capitata* was found in Florida in 1929 and eradicated within two years [*cf.* **19** 44].

F. Kern reports (p. 141) that adults of the Dynastid, *Euetheola bidentata* (Burm.), were observed attacking sugar-cane for the first time in Venezuela in June 1955, in the north of the State of Carabobo. They cut the shoots of newly planted canes near the base, below the surface of the soil. He also states (p. 142) that cotton near the Orinoco River in the State of Guárico was heavily infested in February 1955 by a Cecidomyiid, possibly *Contarinia jossypii* (Felt). This is the first such outbreak to be recorded in Venezuela, though the pest may have been present for some years. The infestation occurred in patches, and the larvae caused deformation of the bolls, resulting in losses of up to 30 per cent. of the crop in some areas.

Simmonds (H. W.). **The Rhinoceros Beetle,** *Oryctes rhinoceros*. **Certain Factors which may tend to inhibit its Increase or check its Spread in Fiji.**—*Agric. J. Fiji* **24** no. 3–4 pp. 89–92, 1 ref. Suva, 1953.

Since it was considered that the distribution and spread of *Oryctes rhinoceros* (L.) on coconut in Fiji [*cf. R.A.E.*, A **44** 269] formed a pattern different from that observed when the beetle first reached Samoa, attempts were made to discover any natural factor limiting its increase or checking its spread in Fiji. There was no indication that climatic conditions hindered development, and a search for predators revealed none of importance. Notes on those found are included. It is observed that the establishment of effective predators would be largely prevented by the presence of the toad, *Bufo marinus*.

Hille Ris Lambers (D.). **Notes on Aphids from** *Cocos nucifera*.—*Agric. J. Fiji* **24** no. 3–4 pp. 93–95, 6 refs. Suva, 1953.

While studying the inhabitants of Aphid galls on *Styrax*, the author observed that the migrants contained embryos of an unusual type and thus presumably migrated to plants of a different order. As experimental transfer in the tropics was impossible, Hormaphidine Aphids from Java were studied. It was found that the embryos of *Trichoregma* spp. were similar to those in migrants from galls of *Astegopteryx styracophila* Karsch (the type of its genus), and alates from these galls produced larvae on grasses. These did not become adult, but it was concluded that *T. pallida* (v. d. Goot) is a synonym of *A. styracophila*, and *Trichoregma* consequently a synonym of *Astegopteryx*. In samples from bamboo, some of the alates contained embryos similar to those in apterae in galls on *Styrax* and presumably represented the return migrants.

Three types of galls from *Styrax benzoin* were received. One of them contained migrants that produced brown larvae on *Kentia* sp., and these larvae were similar to those of *A.* (*Oregma*) *nipae* (v. d. Goot). It is thus apparent that *Astegopteryx* spp. migrate to secondary food-plants and that on palms and bamboo they have been identified as *Trichoregma* spp. They can, of course, maintain themselves on these secondary food-plants in the absence of *Styrax*. Collections of *A. nipae* from coconut in Malaya, eastern Java and Guadalcanal usually included examples of a species for which the name *A. rappardi*, sp.n., is here proposed; characters differentiating the two are described. *A. rappardi* occurs in large numbers in clusters on the lower surfaces of the coconut leaves, which develop yellow spots, and may become a severe pest. Both species are visited by the ant, *Oecophylla smaragdina* (F.), in Java.

A migration to *Styrax* was shown by similar methods also to occur in *Cerataphis*, but the species concerned was not determined. The gall contains inhabitants previously described by the author as *Astegopteryx fransseni* [*R.A.E.*, A **21** 504], and migrants from this gall produced typical *Cerataphis* larvae. Furthermore, alates of *Cerataphis* spp. were obtained that contained embryos of the *Astegopteryx* type, as well as those containing normal *Cerataphis* embryos. The forms occurring in the tropics and in hothouses on palms and orchids are generally assumed to be *C. lataniae* Boisd., but the author considers that three species are concerned, *C. orchidearum* (Westw.) on orchids, and *C. lataniae* and one preliminarily differentiated as *C. variabilis*, sp.n., on palms. *C. variabilis* is apparently the common species of its genus on coconut and other palms, with a range extending from Africa to Fiji. A key to these three species is given.

Cohic (F.). **Un dangereux parasite du glaieul introduit récemment en Nouvelle-Calédonie** (*Taeniothrips simplex*, **Morison**).—*Rev. agric. Nouv.-Calédonie* (N.S.) **4** no. 11–12 pp. 18–21, 2 refs. Nouméa, 1953.

The author reviews the distribution, bionomics and control of the gladiolus thrips, *Taeniothrips simplex* (Morison), and states that it was found in New Caledonia for the first time in 1952, near Nouméa, and appeared to be spreading.

Lamb (K. P.). **The Chrysanthemum Gall Midge: a newly recorded Pest.**—*N.Z. J. Agric.* **88** no. 4 pp. 341–342, 2 figs., 2 refs. Wellington, N.Z., 1954.

Diarthronomyia chrysanthemi Ahlberg was observed on chysanthemum in New Zealand for the first time in April 1953 [*cf. R.A.E.*, A **42** 31]. Infested plants were found in several private gardens and one commercial planting in Auckland. Information on the bionomics, food-plants and control of the Cecidomyiid in the northern hemisphere, to which it has hitherto been confined, is reviewed; in New Zealand, development probably lasts 1–3 months, according to season.

Chamberlain (E. E.). **Plant Virus Diseases in New Zealand.**—*Bull. N.Z. Dep. sci. industr. Res.* no. 108, 255 pp., col. front's., 185 figs., 5½ pp. refs. [Wellington, N.Z.] 1954.

This handbook on the virus diseases that attack cultivated plants in New Zealand is in three parts. The first contains general information on the nature, identification, classification, nomenclature, physical properties, host range and methods of transmission of the viruses, with notes on their effects on plants, techniques used in investigating them, and methods of control. The second contains information on specific viruses grouped under the plants attacked. The aspects dealt with are the characteristics of the viruses, their host-plant range, economic importance and method of spread, the symptoms caused, varietal resistance in the host plants, and control. The third part consists of five appendices, comprising a list of the plant viruses present in New Zealand with their natural hosts and methods of transmission, a list showing the alternative names that have been used for some of them; a list of plants known to become infected under natural conditions in New Zealand, with the viruses that infect them, a list of the principal insect vectors (some of which have not been recorded in New

Zealand) of the diseases that occur there, showing the viruses transmitted by them, and a glossary of terms used in the text.

Foucart (G.). **Le sphinx du quinquina** *Celerio nerii* **L.**—*Bull. INEAC* **3** no. 2 pp. 111–122, 1 fig. Brussels, 1954.

Deilephila (*Celerio*) *nerii* (L.) has long been present on *Cinchona* in the Belgian Congo but caused negligible damage until 1952–53, when severe outbreaks occurred in several plantations in Kivu. All stages of the Sphingid are briefly described, and notes are given on its bionomics and control. There are 5–6 generations a year, maximum numbers being reached in March–May and September–November. The larvae attack the leaves, leaf buds and sometimes the non-woody twigs of young plants, and feeding by several successive generations results in almost complete defoliation, though it rarely kills the trees since new leaves are produced between generations. Though occasional examples have been observed on coffee, development cannot be completed on it, and *Cinchona* is the only known food-plant in the Belgian Congo. In the laboratory, the egg stage, the four larval instars, the pupal stage and the preoviposition period lasted 12, 10, 2·5, 5·5, 6, 24 and 8 days, respectively. Pupation normally occurs at the foot of the trees in humus or dead leaves. The larvae are parasitised by the Tachinid, *Actia cibdella* Villen., the percentage parasitism having reached about 25 before the recent outbreaks, but only 3–5 in the last few years. The increases in population of the moth are in part attributed to this fall in parasitism, which is thought to be due to unfavourable weather in 1951–52.

Hand collection of the larvae and pupae is recommended for control, together with the application of sprays against larvae in the early instars. When infested material was brought to the laboratory immediately after treatment in the field, the maximum mortality percentages for young larvae and (in brackets) the numbers of hours in which these were obtained were 100 (9) for a dust containing 1·5 per cent. parathion, 100 (12) and 100 (32) for sprays of 0·1 and 0·05 per cent., respectively, of a product containing 46·5 per cent. parathion, 97 (24) for Cotton dust (3 per cent. γ BHC and 5 per cent. DDT), 95 (32) for a spray of 0·5 per cent. of a product (Solvexane) containing 59 per cent. BHC, and 95 (144) for a 2 per cent. DDT spray. Complete mortality of larvae in the later instars was given in 108, 74 and 32 hours by the parathion dust, the stronger parathion spray and Cotton dust, respectively. Solvexane gave 97 per cent. mortality in 108 hours. In the field, the best results were obtained with Cotton dust, which gave 97 and 95 per cent. mortality of the larvae in the early and later instars, respectively, in three days, and Solvexane, which gave 96 and 92 per cent. mortality, in six days.

Salmond (K. F.). **Insect Infestation in stored Rice in Nyasaland.**—*Trop. Agriculture* (*Trin.*) **33** no. 2 pp. 134–135, 4 refs. London, 1956.

An entomological survey of rice markets and stores in the Northern and Central Provinces of Nyasaland was made in July–August 1953. The rice is harvested in May–July and stored in raised mudded containers, or raised lofts in African dwellings before being threshed and brought to market. The market survey showed that before being husked the stored rice is attacked chiefly by *Rhizopertha dominica* (F.), the small strain of *Calandra oryzae* (L.) and *Sitotroga cerealella* (Ol.), but damage was slight as the grain is marketed soon after harvest. *Oryzaephilus* (*Silvanus*) *surinamensis* (L.) and *Cryptolestes* (*Laemophloeus*) *minutus* (Ol.) were found in rice already damaged by the other insects. Bags of rice awaiting transport to the mill

are subject to attack by termites, but this can largely be prevented by a layer of 2–3 ins. fine sand or 1 in. wood ash under the dunnage.

JOHNSON (C. G.). **Aphid Migration in Relation to Weather.**—*Biol. Rev.* **29** pp. 87–118, 5 graphs, 61 refs. Cambridge, 1954.

The following is based almost entirely on the author's summary. Fluctuations in the numbers of Aphids in the air have hitherto been regarded as due mainly to weather-controlled changes in flight behaviour, and migration has been envisaged largely as a calm-weather phenomenon, the intensity of which is limited mainly by the effects of wind-speed on take-off behaviour. The author refers to this hypothesis, which was developed from both laboratory and field work and has been current for about 20 years, as the "flight-activity hypothesis" and points out many discrepancies in it, two of which are that it does not fully explain changes in numbers of Aphids in flight and that it is apparently inconsistent with the idea of large-scale windborne migrations. The general Aphid population in the air consists of Aphids migrating from the plants on which they have bred and those flying from other places, and failure to distinguish between these and to appreciate that very different factors control the numbers in the two classes has led to confusion. The author puts forward a new hypothesis to explain the variations in numbers of Aphids migrating from their breeding sites, which is based on observations on the summer generation of *Aphis fabae* Scop. migrating from field beans [*Vicia faba*] in Britain [*cf. R.A.E.*, A **41** 119] and is considered to be applicable to many species. Moulting to give rise to adult alates usually reaches a peak in the early morning, and there are usually one or more additional moulting peaks later in the day. The alates usually reach flight maturity within 24 hours of moulting and fly away in flushes on the first migratory flight. The numbers in each flush depend on the sizes of previous moulting peaks and on the duration both of the obligatory maturation period and of the facultative period that follows; thus the vagaries in flight behaviour tend to be obscured, and the process is only weakly correlated with current weather factors. The numbers on subsequent flights will also depend on previous population (moulting) changes as well as on behaviour. Aphids lose their ability to fly owing to autolysis of the flight muscles a few days after they have left the original food-plant, and the rapidity with which this occurs will exert a considerable effect on the numbers on flights subsequent to the first migration and on their ability to spread virus diseases. The quality of their flight may also be affected. Little is known of the biology of Aphids after the first migratory flight, or of the relative effects of the factors affecting their numbers in the air. It is suggested that a considerable proportion of all the Aphids in the air are on their first migratory flight and that the number on subsequent flights may be more limited than seems to have been envisaged.

The flight-activity hypothesis is reviewed critically in detail and shown to contain three main defects. These are the assumption that most of the Aphids migrate in high local concentrations during occasional calm periods [*cf.* **29** 180; **30** 243; **39** 46], whereas most do so in lower densities on the more numerous windier occasions; the assumption that changes in number of Aphids in the air from day to day are due mainly to variations in flight behaviour, instead of being mainly collective population changes subject to different laws from those applying only at the individual level; and errors in measurement and treatment of data. The data of previous authors are analysed to illustrate these errors and to disprove previous contentions.

Various aspects of Aphid dispersal are discussed in the light of old and

new hypotheses and with reference to their significance in the spread of virus diseases. The aspects considered are population change and migration, active and passive flight [*cf.* **31** 386; **39** 48; **43** 89], migratory and non-migratory flight, the supposed effects of humidity [*cf.* **26** 709; **31** 384; **37** 484, etc.], and the so-called optimum conditions for flight.

McLeod (J. H.). **Statuses of some introduced Parasites and their Hosts in British Columbia.**—*Proc. ent. Soc. B.C.* **50** (1953) pp. 19–27, 19 refs. Vernon, B.C., 1954.

The status of the parasites and predators introduced into British Columbia against 11 introduced insect pests is reviewed, with special reference to investigations in 1949–53. The Scelionid, *Allotropa utilis* Mues., which was released in orchards in the Kootenay Valley in 1938–43 against *Phenacoccus aceris* (Sign.) [*cf. R.A.E.*, A **38** 486], is well established and affords adequate control. In 1948, a few adults were liberated in an infested area on Vancouver Island, and *P. aceris* has been controlled there since 1949. A factor contributing to its success is the ability of *A. utilis* to survive the sprays of dormant oil and lime-sulphur applied against the mealybug [*cf.* **31** 152], the parasite being in the pupal stage at the time of application and protected by the mummified remains of the host. *Ascogaster quadridentata* Wesm. was released against *Cydia* (*Carpocapsa*) *pomonella* (L.) in orchards throughout the Okanagan Valley in 1934–37 and 1939 [**25** 189–190] and became established, but has not increased sufficiently to afford control. *Ephialtes caudatus* (Ratz.) and *Cryptus sexannulatus* Grav. were imported from France and also released against *Cydia*, the former in the Okanagan Valley in 1942 and 1946 and the latter in the interior of British Columbia in 1941, 1946 and 1947, but neither has been recovered.

Hemisarcoptes malus (Shimer), which was introduced into British Columbia against *Lepidosaphes ulmi* (L.) on fruit and other deciduous trees [*cf.* **12** 52], is widely established and has at times afforded important control. Populations of this mite were severely reduced in the winter of 1949–50, when the temperature fell below −30°F. at many places. It is stated from information supplied by J. Marshall that *Aphelinus mali* (Hald.) gave effective control of *Eriosoma lanigerum* (Hsm.) on apple [*cf.* **38** 486] until the use of DDT against *C. pomonella* became general in 1945. DDT is toxic to the parasite but not to the Aphid, and the latter has once again become a major pest. Lecanium scales, including *Eulecanium* (*Lecanium*) *corni* (Bch.) and *E.* (*L.*) *coryli* (L.), have not been of importance since the introduction of *Blastothrix sericea* (Dalm.) in 1928–29 [*cf.* **42** 221, etc.].

Ascogaster quadridentata and *Glypta haesitator* Grav. afford useful control of *C.* (*Laspeyresia*) *nigricana* (Steph.) on peas [*cf.* **38** 486]. The very considerable reduction in infestation by the moth since 1946 is attributed largely to harvesting for canning, before the larvae have completed their development, but considerable populations are still present on wild plants, especially vetch (*Vicia angustifolia*); in 1951, 45·1 per cent. of the larvae on these were parasitised by *A. quadridentata*, 13·8 per cent. by *G. haesitator* and 2·7 per cent. by unidentified Hymenoptera.

Mesoleius aulicus (Grav.) (*tenthredinis* Morl.) proved very effective against *Pristiphora erichsonii* (Htg.) on larch [*cf.* **32** 175–6; **44** 184], the percentages of parasitism by this Ichneumonid in a localised infestation in 1948–51 being 66·2, 61·5, 54·9 and 68 in the four years, respectively. In 1952–53, the level of infestation was too low for parasitism to be evaluated. *Endasys* sp. and *Euceros* sp. are parasitic on *M. aulicus* but are present only in small numbers. The Tachinid, *Ptychomyia selecta* (Mg.) (*Bessa harveyi* (Tns.)), also became established on *P. erichsonii* but is not of

economic importance, and *Zenillia nox* Hall, which was released against the sawfly in 1935, was not recovered [*cf.* **32** 176]. *Tritneptis klugii* (Ratz.), which apparently spread to British Columbia from Montana, oviposits indiscriminately in the cocoons of *P. erichsonii* and destroys many larvae already parasitised by *M. aulicus*.

No serious outbreak of *Stilpnotia salicis* (L.), which formerly caused considerable damage to willow and other trees [*cf.* **19** 33], has occurred since the introduction of parasites against the larvae. *Apanteles solitarius* (Ratz.), *Compsilura concinnata* (Mg.) [*cf.* **20** 68] and *Meteorus versicolor* (Wesm.) became established, and a combined parasitism of 64·1 per cent. was observed in 1951, *M. versicolor* predominating. All three species were themselves parasitised by *Dibrachys cavus* (Wlk.), and *M. versicolor* also by *Gelis tenellus* (Say), but the hyperparasites were not abundant.

Of the five parasites introduced against *Phytomyza ilicis* Curt. on holly [*Ilex aquifolium*] in 1936–39 [*cf.* **29** 417], *Cyrtogaster vulgaris* Wlk., *Opius ilicis* Nixon, *Sphegigaster flavicornis* (Wlk.) and *Chrysocharis gemma* (Wlk.) were found in 1949–53, though *Chrysocharis* was taken only on Vancouver Island and *Cyrtogaster* only on the mainland. Total parasitism averaged about 30 per cent. *Chrysocharis* was responsible for over 90 per cent. of the parasitism on Vancouver Island and *Opius* for 80–90 per cent. of it on the mainland. The parasites are probably of greatest value in ornamental plantings, which are seldom sprayed against pests.

More than 250,000 individuals of *Bigonicheta setipennis* (Fall.) were reared from stock obtained from Oregon and liberated at various places in British Columbia between 1934 and 1939 against *Forficula auricularia* L. In 1945, 70 per cent. parasitism by this Tachinid was recorded in Vancouver. In 1951, the percentage parasitism was found to be 10·9–50 on Vancouver Island and 1·6–30·4 on the mainland, and in other investigations in the Vancouver area in 1950–52 [*cf.* **42** 51], it was 10·8–18·9. *B. setipennis* is the only parasite reared from the earwig in British Columbia and is its most important natural enemy there, though it is not numerous enough to give complete control. The puparia are parasitised by a Pteromalid of the genus *Dibrachys* that is distinct from *D. cavus*, which parasitises the Tachinid in Britain.

Laboratory rearing of *Encarsia formosa* Gah. for release in greenhouses and conservatories against *Trialeurodes vaporariorum* (Westw.) [**26** 623] is being continued.

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Fulmek (L.). **Wirtsbereich von** *Trichogramma evanescens* **Westw. und** *Tr. minutum* **Ril.** [Host Range of *T. evanescens* and *T. minutum* (a review of the literature).]—*Anz. Schädlingsk.* **28** pt. 8 pp. 113–116. Berlin, 1955.

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